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LAYING THE LARGEST SUBMARINE POWER CABLE

BY JOHN A. KOONTZ JR.

(The methods used in laying the new 22,000 volt cable of the Great Western Power Company under San Francisco Bay are described in detail. The illustrations are particularly effective in showing each step in splicing the cable. The author is an engineer with the Great Western Power Company.—The Editor.)

Cable Laying Barge, Showing Cable Grip.

The Great Western Power Company has just placed in operation its second 11,000 volt, submarine power cable, across San Francisco Bay. This cable is the largest high voltage submarine cable in operation in this country, as it is larger by some 18 per cent than the first transbay cable installed by this company, as described in this journal March 16, 1912.

The cable in question is a three conductor, graded insulation, armored cable of an overall diameter of 4 in. It runs from a point near the ferry slip on the Western Pacific Mole in Alameda county, to Harrison street wharf, in San Francisco, a distance of 20,788 feet. It was necessary to make this cable in sixteen lengths, each length being shipped on a separate reel, the weight of which was 15 tons.

The major portion of the cable contains 3-250,000 cm. stranded copper conductors, first insulated with a coat of 6/32 in. 30 per cent para rubber compound, then taped thereover with 2/32 in. of varnished cambric. The insulated conductors are then spirally wrapped, and the spaces filled with jute and insulating compound. Overall is wrapped a belt of 5/32 in. of varnished cloth. Next is placed a lead sheath 5/32 in. in thickness, then a coating of jute, next the armor wires, and as a finish the cable is given a final jute coat.

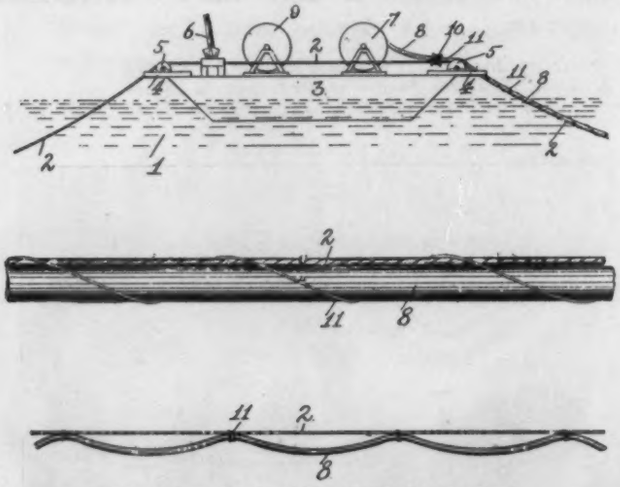
At the shore ends on account of the poor radiating conditions to which they are subjected, the conductors are of 300,000 cm. cross section, the same grade and thickness of insulation being used as in the 250,000 cm. cable.

Numerous submarine and river cables are operated by this company, varying in voltage from 2200 to 22,000 volts, and in no case to date have we a record of the failure of the cable proper, except as caused by some outside mechanical injury, such as being cut by propeller blades, or pulled apart with an anchor. All electrical failures have been at the joints.

The most difficult problem in installing a submarine power cable is to make the joints in such a manner that no mechanical strain be thrown on the conductors or lead sheath while the cable is being installed or repaired. The armor wires are spirally wrapped around the cable, and it is practically im-

possible at a joint to get these wires so served and wrapped that the armor will take all the strain. Any severe strain on the cable tends to lengthen the armor wires due to this spiral wrapping, as the material of the cable has a more or less plastic nature. The armor wires when stressed will grip the cable and embed themselves slightly into the jute and lead, thus allowing them to increase in length without a corresponding increase in length of the lead sheath or copper conductors.

Mr. A. J. Pahl early realized the difficulties in handling submarine cables, and the strains to which they are subjected in laying, so to overcome these difficuties he devised and patented the use of a messenger cable. The function of this messenger cable



Patent Drawing of Cable-Laying Method.

is quite like that of an aerial messenger, its object being to support the power cable, taking all the strains and provide a means of directing and anchoring the barge while reeling out or splicing the power cable.

In the present installation the 1⅛ in. steel messenger cable was first securely fastened at the San Francisco end, then reeled out across the bay to the Western Pacific Mole. Brakes were used on the reel to prevent excess slack in the messenger cable only at points where a change in course was made. Upon reaching the Western Pacific Mole the other end of the messenger cable was securely fastened.

A 150 ton barge was equipped with sheaves, cable grip, and reel supports, and the barge loaded with four reels of cable. The steel messenger was then picked up and placed in the sheaves, and the power cable started overboard. The power cable is lashed to this messenger, using a continuous wrap of No. 6 galvanized wrie, and at 20 ft. intervals the two cables are firmly served together.

The barge was towed by a 40 h.p. launch, which was directed over the original route, the messenger cable in itself tending to keep the barge in the proper course. By the use of the cable grip the barge is started and stopped at will, for the launch is kept towing continuously while the power cable is being reeled out. When the end of a reel is reached the cable grip is set and the barge stopped.

The armor on the two ends that are to be spliced together is laid back and the lead sheath cut away, and the conductors bared for the splice, as shown in Fig. 1. A portion of the cable proper of each end to be spliced, is cut away leaving the armor wires. This is to give sufficient length of armor wire to serve properly over the splice. It is well to note in this figure the spreaders used to keep this armor wire in position.

In Fig. 2 the copper sleeves are in place over the joints in the conductors; also the lead sleeve has been slipped over the cable and is ready to be drawn in place after the conductors are insulated.

The joint has been completed, in Fig. 3, the lead sleeve having been drawn into place, wiped, filled with compound and sealed. The joint is now ready for its jute covering, Fig 4.

The armor wires from one side of the splice are now wrapped back over the joint, at places passing over interlocking rings, as shown in Fig. 5. These interlocking rings are for the purpose of binding the armor of the two pieces of cable securely together.

After the first layer of armor wire is placed and served, as shown in Fig. 6, the armor from the other side of the splice is then wrapped over the joint and again securely served. The final appearance of the joint is as shown in Fig. 7.

This present cable was laid under contract by Mr. A. J. Pahl, who guarantees the cable for sixty days after acceptance and commencement of operation. Before acceptance, the cable was given a test of 22,000 volts, between conductors and sheath, and 30,000 between conductors, each test being applied for a period of five minutes. The point of reliability of high voltage submarine cables for duty the same as that in San Francisco Bay has been proven without a doubt by this company, for it has 2-22,000 volt cables operating across the Carquinez Straits. One of these cables has been in operation two years, the other eighteen months, there being only one case of trouble in either cable up to this time, and that was due to a sugar steamer catching the cable while dragging anchor, and pulling both power and messenger cables in two.

RESIDENCE SERVICE CAMPAIGN.

The Commercial Section of the National Electric Light Association now has ready its Residence Service Advertising Campaign for the use of member companies in obtaining residence business, housewiring, etc., and in furthering the use of current consuming appliances.

This service comprises 13 separate pieces of advertising literature, including snappy, suggestive booklets, mailing folders, and fac-simile letters with return cards, designed to cover a maximum period of twelve months, or to be mailed twice a month if necessary, space being provided on each piece of printed matter for the imprint of the local company making use of this service. The scheme is so flexible that large companies having their own advertising departments will find that this service may be dove-tailed into their existing or prospective new business campaign with the greatest ease and with the most gratifying results. Other companies who may lack the facilities of an advertising department, or who can hardly afford the expense of employing advertising experts to build up special campaigns, will find this Residence Service Campaign a wonderfully effective and inexpensive solution of one of their most difficult problems.

METHODS OF SPLICING POWER CABLES.

Fig. 1. Conductors Bared for the Splice, (21 in. between Ends of Lead Sheath, 6 in. Sleeve on Conductors). Note Rings for Laying Back Armor wires, 42 No. 4 Galvanized Steel.

Fig. 2. Sleeves Soldered on Conductors, (Sleeves ¾ x 6 in.; Ends of Lead Sheath 24 in. Apart, Lead Sheath, 4½ x 36 in.)

Fig. 3. Filling Sleeve With Ozite Compound After Joint Is Wiped.

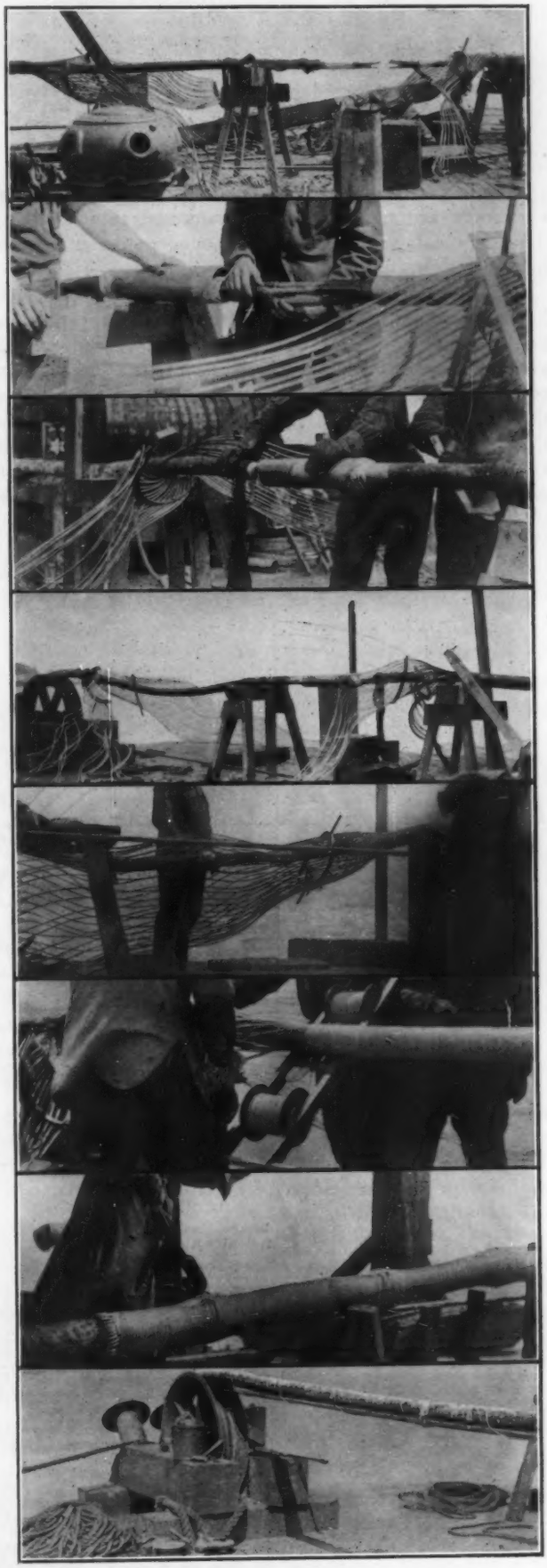
Fig. 4. Joint Sealed and Ready for Jute Wrapping.

Fig. 5. Laying Down Armor Wires Preparatory to Serving. Interlocking Rings are 4 in. Long With Double Taper, ⅝ in. Thick, Center Turned and Bored from Solid Shafting.

Fig. 6. Serving First Layer of Armor With No. 9 Galvanized Steel Wire.

Fig. 7. Completed Serving Over Outside Armor, Showing Ends of Armor Wires Turned Back to Prevent Cutting Into Lead Sheath. Bulges are Caused by Interlocking Rings.

No. 8. Method of Serving Power Cable to Messenger Cable With Continuous Special Wrap of No. 9 Galv. Wire and 20 Turns of Wire Every 20 ft. Also Showing Special 2.4 ft. Sheave With Deep Groove for Messenger Cable.



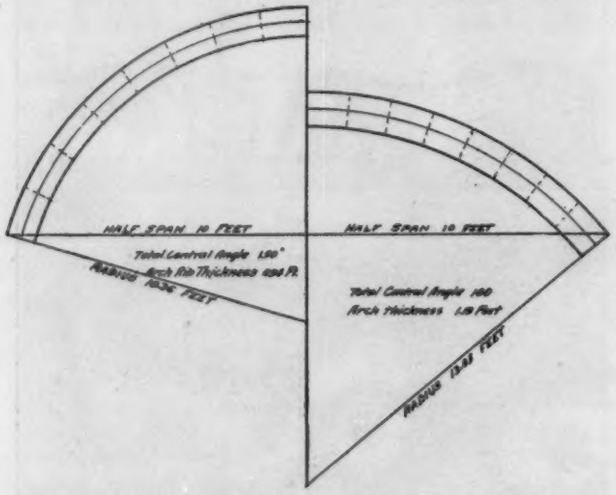
ANALYSIS OF ARCH DAM STRESSES.

BY GALE S. STROUT.

(Important conclusions are reached by considering each element of the multiple arch dam as an elastic arch whose secondary stresses are analyzed under water load and temporary change by the author. Mr. Strout, whose office is in the Sheldon Building, San Francisco, gives high praise and credit to the Eastwood multiple arch dam.—The Editor.)

It is gratifying to note the increased interest that engineers are taking in the structural type of dam. This is clearly evinced by the ever increasing number of articles appearing on this subject.

The writer claims to be a conservationist, and has always enjoyed reading articles that appeared to lead to this end. He has for several years read all articles upon the arch dam, that have ever come to his attention, but never entered into the study of it seriously until the fall of 1912. At that time he was with the State Railroad Commission of California in the hydraulic department of engineering, and the plans for the Big Meadows Dam, then being built by John S. Eastwood for the Great Western Power Company, were brought there for a thorough analysis. It fell to the lot of the writer to make the stress analysis. This proved exceed-



Graphical Comparison of Arch Ribs Considered.

ingly interesting, and although some startling revelations were brought to the surface, the result of the study made him not only a convert but an advocate of this type of dam, when physical and financial conditions will warrant its use.

Of the articles appearing upon the arch type of dam, the writer has never seen one that has entered into the subject and made the analysis as is customary with the design of an arch bridge. That is, treat it as an elastic arch, and determiine the secondary stresses set up by the deformation of arch rib due to shortening under water load, and shortening and lengthening under temperature change.

It is the writer's intention in this article to deal only with this one element of design.

An arch ring subtending a central angle of 133 deg. 34 min. is recogniized to be the economical arch for spanning a given uniform opening. This is true for a minimum of material in the arch ring, considering the standard formula:

$$T = p\,r \quad \ldots\ldots\ldots\

In these figures no recognition is made of the steel reinforcement, but the arch is treated as though built of concrete. For economy this should be the case, and what steel is placed in the structure should be treated as a reserve and insurance against local temperature cracks and abnormal conditions.

In further justification of a thin arch for ultimate economy and strength, it might be well to consider the nature of the load that the arch rib has to carry. Some writers choose to consider the arch rib as a column. If such were the case there would be a definite limit to the thickness. But there is theoretically no logical reason for considering it as a column. A column receives its load at one end. This load is transmitted through the column to the other end with no lateral support to assist the material of which the column is composed. It is therefore of vital importance that the ratio of thickness of column to its length, be kept at a minimum. With a circular water-loaded arch rib, the loading is a condition of absolute equilibrium. In this case the load originates along the arch rib uniformly, and is reacted upon at the buttresses. If the buttresses are unyielding, and the arch rib is a true circle, horizontally placed, then nothing but destruction by crushing could cause a failure.

At the time of the San Francisco earthquake, the writer made numerous observations that at first seemed contrary to what would be expected. Buildings pivoted on jacks preparatory to moving or raising were unharmed. The earth had merely vibrated beneath them, upon the same principal as the siesmograph. Many well built frame houses were torn and split, while many cheaply built houses were unharmed. In the former case the earth movement had been transmitted to the building through its rigidity. In the latter case the building had not received the full movement of the earth and that portion of the movement received had been dissipated through the elasticity of the structure without damage. This same condition, the writer believes, would hold true of a water loaded arch. The more capable it is of resisting shock, the more enduring it would be as a structure under abnormal conditions.

In beginning this article the writer promised to confine himself to the arch. It is a temptation though to reach out and speak of the many advantages offered by the arch type of dam, especially as to its flexibility in meeting varying conditions. But these points have been well covered by others so he shall abide by his promise.

The writer believes that the structural type of dam has a big future before it, and that the engineering profession is awakening to its possibilities.

The density of oil is usually expressed in degrees Baume, or the reading of a Baume hydrometer floating in the oil. Water is taken as a standard with a graduation of 10. The instrument sinks further in oil than in water and consequently shows a higher reading—the lighter the oil the higher the reading in degrees B. Density is also expressed in terms of specific gravity, which decreases as the Baume scale increases. Thus a specific gravity of 1 corresponds to 10 degrees B., of .9 to approximately 25 degrees B., and of .8 to about 55 degrees B.

OREGON HYDROELECTRIC COMMISSION REPORT.

BY W. D. B. DODSON.

(This is the first annual report of the commission's work, Mr. Dodson being secretary. It was presented at the Commonwealth Conference in Eugene on May 28, 1914, It constitutes a masterly discussion of the power and industrial situation in the state.—The Editor.)

Oregon has two superb assets, productive soil and water power, both yet in a somewhat neglected state. For the want of an adequate market, development of both are retarded. It may be that speculative profits of an abnormal character enter the cause for the backward state of each. In whatever measure this may be the case, they must be eliminated. Proper investment to the end of maximum production will be protected. But so far as the speculator stands between production and the consumer, he must be urged to stand aside. If our rich soil, now idle in millions of acres, is held at too high a price for the thrifty, frugal husbandman, a better opportunity must be opened. Those hardy workers, seeking the haven of an independent farm home, who are turning to the cheap lands of other parts of the world, must be drawn here and given a full, fair, honest opportunity. Personally, I believe that no effort is too great for the state to make to attain this end. It is in the realm of possibility. It must be done.

Water power, industry's supreme desire, also flows to waste on every hand throughout the state. How we can utilize it in practical manner is a problem of such urgent, imperative, far-reaching moment, that the state might well give it thought second to full cultivation of the soil. If this wasting energy is 3,000,000 horsepower, on the minimum flow of the streams, as has been officially estimated, or if it is 6,000,000 horsepower, as some private engineers assert, it would turn the wheels for several million busy, prosperous workingmen. How to get these workingmen and the industries upon which they are dependent, is the monumental work which the commission has essayed to determine, although our beginning has been humble and barely perceptible on the part of the masses of the people.

Oregon has many industrial disadvantages in competition with the old institutions of the East. We have no commercial deposits of iron, measured by present reduction systems, so far as exploration of the geologist and mineralogist have gone. We have no valuable coal measures. Oil has not been tapped in paying quantities. Our wage scale is relatively high. Population is sparse, transportation to consumers in large numbers is high, and distance may not be annihilated. We have found that even the limerock needed for certain electrical industries, the rock that is usually regarded plentiful as common stone, did not exist in that purity near certain centers which was demanded. All these and many others are limitations placed by Nature and the condition of things which it is idle to combat. But we have water power, in greater measure than any other state with the possible exception of Washington. We have this asset in such abundance that it actually palls, like the Douglas Fir forest when the first settler came. Abundant as it is, it yields us little more than nothing.

Development of this asset can be achieved. It is one of those reasonable possibilities worth trying. Extensive success means so much to the state that Oregon, in any fair business study, could afford to make an enormous investment in trying to harness the wasting energy to the wheels of industry. While the official estimate of the commercial energy at the minimum flow of the streams of the Columbia Basin is put at 12,775,000 horsepower, there are actually being utilized of this a scant 300,000 horsepower. You will appreciate from this disparity that a bare suggestion of use exists now. Where a few thousand people are employed as a result of the harnessing, millions could be accommodated if only we could devise the ways and means to turn the tide of National industry dependent upon electrical energy or cheap power to this State and its tributary region.

I review these generalities to place before you the stupendous nature of our problem. With the impression as to the enormity of the work, must also go the conclusion as to benefits when success is attained. One-half a horsepower effective through the year, is sufficient for the manufacture of a ton of artificial nitrates by the fixation process. One-third of a horsepower is equal to the task of producing a ton of pig iron from raw iron ore. You know the energy required in various factories, where a thousand horsepower means a big payroll.

With a profound conviction of the benefits to be derived, and many vivid suggestions of the difficulties to be overcome, the Oregon Hydroelectric Commission set about its work. Immediately authority was granted at the last Commonwealth Conference Chairman H. B. Miller named as his co-workers the following persons:

Judge Thomas C. Burke, collector of customs at Portland, vice-chairman; Prof. F. G. Young, father of the Commonwealth Conference movement, and jointly with the state engineer father of the hydroeletric commission; Prof. Thomas A. H. Teeter, instructor in hydraulics at the Oregon Agricultural College; Dr. J. F. Watt, Hood River; W. H. Graves, president of the Oregon Society of Engineers; J. V. Tallman, president of the Pendleton Commercial Association; H. L. Vorse, electrical engineer, Portland; Hon. John McCourt, ex-United States District Attorney for Oregon; William Hanley, Burns; C. A. Park, Salem; T. H. Burchard, president of the Oregon State Federation of Labor; B. G. Leedy, chairman of the State Grange committee studying water power resources; Mrs. Clara Waldo, a leading agricultural and industrial worker of the State Grange, and W. D. B. Dodson, trade commissioner for the Portland Chamber of Commerce.

This body resolved itself into almost as many sub-committees as it had members at the first meeting. Each committee was charged with the duty of investigating some phase of water power resources, electrical generation, and the application of electrical energy to agricultural and industrial production. This work is proceeding slowly, as the individual committeemen have their own business affairs as a first call upon their time, but are giving generously to the research work of the commission.

As the base of procedure, the commission has inaugurated the effort to get from all parts of the world accurate, complete data on electrical developments. As the first step in the quest, the secretary of state for the federal government has been requested to have each consul in the national service answer an exhaustive series of questions as to actual achievements in his district. This query covers all details on cost of construction, operation, transmission, etc., divided into units in such manner that satisfactory comparison may be made in this country where varying wage scales, material costs and overhead charges are found.

Our first response to this line of inquiries brought the definite statement that in Norway the construction cost of water power plants varies from $26.80 to $53.60 per horsepower for large plants, and $26.80 to $134 per horsepower for smaller ones, while the charge for the energy ranges from $8.04 up to $13.40 per horsepower per year, 24 hours a day service. In this work the commission intends to go deeper, test the accuracy of statements, and when absolutely authentic figures are secured, give the same general publicity. We are inquiring particularly as to the use of electricity in mineral reduction work, and have made our questions very complete in respect to the nitrate and iron and steel industries.

Following up this line of inquiry in a more complete manner, it is the desire of the commission later to have special reports made on great works that have proven of exceptional value in their influence upon industries. To do this, competent engineers will have to be sent on long journeys. For such work, we will have to raise funds, and plan at a later date to ask for voluntary subscriptions from those interested or those grasping the significance of the state's water power resources. We recognize that it is accurate data that will be of use. Only when the people are correctly informed will they be able to act intelligently on their own problems.

One of the first duties the commission undertook was to exercise its maximum influence in trying to have federal laws and regulations made most helpful, and fixed in the principle of not trying to make water power development on federal reserves of the West a source of national revenue. A sub-committee was named by the commission, of which Prof. Young was chairman, to formulate a resolution conveying this thought, and it has been transmitted to the Oregon delegation. Congressman N. J. Sinnot hastened to reply that he had urged before the House committee considering a federal power bill, an amendment embodying identically the same thought as the commission presented, and while defeated before the committee, would again present the amendment before the House when the bill comes up. When we consider that the Forestry Department estimates the commercial water power on federal holdings of this character at 12,000,000 horsepower, practically all in the West, we quickly appreciate the moment of having the most liberal policies in vogue. What might be developed in the navigable streams held under the jurisdiction of the War Department, and what might be had from the reserve holdings controlled by the Interior Department, would bring the total under federal control up to an enormous figure. We believe that the entire West must be aroused to fight against the principle of deriving revenue from such development

work. Such income as will defray the expense of administering the department could be tolerated, if not unduly swollen, but in whatever measure the federal power undertakes to secure a net profit for general use, we will oppose with all possible energy.

Helping in the cause of co-ordinate power and navigation improvement, getting districts organized along navigable rivers for joint power and navigation assessments of the local property, aiding to enact the constitutional amendment permitting the state to sell bonds for arid land reclamation, logged off land clearing, or power development work; studying the whole range of the electricity market in the Northwest; starting inquiries as to the cost of energy under private and municipal or state control or in state ownership; interesting the engineering societies engaged in electro-metallurgical and electro-chemical industries to hold conventions in the Northwest; inviting private capital to study local resources, and to engage in industries that will use electrical energy, and a multitude of other lines of endeavor have been taken up by the commission. All of these we hope to press with such vigor as to get tangible results in due time.

Some of the members of our commission have enjoyed opportunity during the past year to get intimate knowledge of the requirements of the nitrate manufacture. An engineer from one of the great operating companies of the East toured the Pacific Coast for a location of a nitrate plant. He asked for figures on power costs, the availability and cost of the raw materials, and market conditions. This study revealed that the Portland district is deficient in suitable lime, and that both coke and lime are important studies for Oregon in inviting the nitrate industry. As a result of this investigation we have concluded that, concurrently wiith the furnishing of cheap power, we must make commercially available the mineral raw materials. Our commission will use this information to best advantage, and seek to enlist the other agencies of the state in procuring these elements.

Most energetic work has been done in trying to secure the fundamental requirements for utilizing electric energy in reduction of iron ore and in the manufacture of steel. Outside sources of supply of iron ore have been taken as the basis. At present China seems to be the most likely, and may continue so unless more stable political conditions in Mexico make Lower California deposits inviting to capital, or unless improved transportation to the west coast of South America brings deposits there nearer. China's ores have been laid down on this coast at slightly above $4 a ton, and current information indicates that such figures are permanent possibilities. Prof. Stafford of the university, gave to the commission recently a succinct outline of the progress being made in electrical reduction of iron ores, which further proved that the industry will soon be of vital interest to the Pacific Northwest.

The commission has found a strong sentiment of support among the business element of the state, which will take substantial form no doubt as soon as the work is better organized. We have been given strong assurances by the Portland commercial and industrial bodies, the membership of which appreciates the value of more extensive power development. The state engineer, Hon. John H. Lewis, who has been one of the most powerful workers for increased use of Oregon's idle water resources, has given a helping hand at every opportunity, and will become the commission's official ally in the coming years. Mr. F. A. Henshaw, district engineer for the Geological Survey, in charge of the water resource department, has been as ready as any one could be to help and guide in the most useful directions. The commission has tendered its services to the state commission making a survey of the Five Miles Rapids project at Celilo, in seeking out a power market for such energy as may be found commercially available there, and when the estimates on the cost of this work have been reached, it will be the purpose to make a most vigorous campaign all over the country to determine if the energy indicated may be contracted to some great manufacturing institutions. The commission has gone further, and tried to interest manufacturers in the surplus of electrical energy now available in the state.

APPLIANCE SALE BY UTAH LIGHT AND RAILWAY COMPANY.

The Utah Light & Railway Company announce a change of policy in the operation of its commercial office and electric shop at Salt Lake City. The company's general offices are one block from the main business street at a rather inconvenient location for its patrons. Its office quarters at this location were so crowded that it was impossible to find space to introduce a display of current consuming appliances, a thing which the company had felt the necessity of for some time. They decided to obviate these difficulties by renting an office on Main street and fitting it up as a commercial office and electric shop, which was opened to the public in December of last year.

The company did not intend at the outset to sell electric appliances at this new shop, but simply to have them there on demonstration and to refer prospective purchasers to the various electric supply dealers of the town who handle these appliances. The careful observation of this plan of conducting a demonstration room only has convinced the officers that the results secured do not justify the expense of operating a demonstration on the somewhat elaborate scale that the company has installed. It was apparent that the stock in a short time would have an obsolete and shopworn appearance, which does not obtain in a store where the stock is being turned over two or three times a year.

Viewed from every standpoint the company felt that in order to achieve the greatest results not only to itself, but to the entire electrical industry in the territory it served that they should inaugurate a vigorous sales policy conducted along progressive business lines. They took the matter up with the various electric supply interests and explained that their plans were to continue to co-operate with the supply dealers as they had done in the past by maintaining such prices as would give a fair profit to themselves and to the dealers and by purchasing their appliances through local jobbers when this could be done on equally advantageous terms. The dealers have viewed the matter broadly and have proffered their continued active co-operation and support as they have in the past.

A LABORATORY SOURCE OF SUSTAINED HIGH VOLTAGE AT HIGH FREQUENCY.

BY J. C. CLARK.

(This is the first of a series of articles concerning the marvelous experiments with high voltage at high frequency which are being conducted at Stanford University under the direction of Prof. Harris J. Ryan, assisted by Prof. Clark. This paper describes the apparatus used, the next will describe the experiments, and subsequent articles written by Prof. Ryan will take up the high voltage potentiometer and its application in determining the voltage duty of the units in suspension type insulators. The articles are not only of intense theoretical interest but of great practical value in determining why insulators fail.—The Editor.)

For some years it has been known that many insulator failures are chargeable to the damaging presence of high frequency currents on electric transmission and distribution lines. Accordingly, the need has been felt in many quarters for a more extended knowledge of the properties of high frequency electricity. It was in response to this need that certain apparatus to produce sustained high frequency high voltage for experimental study has been developed in the electrical engineering laboratory at Stanford University by Professor Harris J. Ryan and the writer, and it is the purpose of this article to describe this apparatus.

As to the means of securing sustained high frequency oscillations, the general method which seemed most promising at the outset was that which depends upon the well known property of a continuous current arc in exciting oscillations in a low resistance circuit containing inductance and capacity shunted across the arc. Various investigators have developed this method differently as to details, but the arrangement of Valdemar Poulsen has proven to be the most satisfactory for steadily circulating large amounts of reactive power in the oscillatory circuit. The Poulsen Arc-Generator (for a detailed description of which the reader is referred to "Wireless Telegraphy" by G. W. Pierce, Chap. XXIII.), consists essentially of a continuous current arc between positive copper and negative carbon electrodes. This arc is formed in an atmosphere of reducing gas, or vapor, and a strong magnetic field excited by the arc current itself is so mounted as to blow out the arc. The generator is capable of operating under these adverse circumstances only when a rather high continuous voltage is applied to the arc and when it is shunted by a freely oscillating circuit of inductance and capacity.

In the fall of 1912, the department came into the possession of a 5 kw. Poulsen Arc-Generator, Fig. 1, together with a copper helix and a quantity of supplies, through the generosity of C. F. Elwell, then chief electrical engineer for the Federal Telegraph Company. Pending the provision of more suitable quarters in a new high voltage laboratory, the generator was temporarily installed in the main electrical engineering laboratory at Stanford, and an oscillatory circuit provided for the circulation of high frequency current. The latter circuit consisted at first of the small helix above mentioned, and shown in Fig. 2, connected to an air condenser made of several galvanized iron cylinders each 5 in. in diameter and 6 ft. long with closed hemispherical ends.

The need for measuring the high frequency voltage produced in the small helix presented itself at once to the observers, as did also the lack of suitably developed apparatus at hand for such measurement. In considering the field of possibilities as to apparatus for high frequency voltage measurement, only one expedient seemed at all promising; viz: the measurement of sine wave current running into a condenser of known capacity at measured frequency. For the measurement of frequency, a standardized "wavemeter" was used. This consists of a standard inductance, an adjustable standard condenser, and a hot-wire ammeter, all connected in series. This condenser was adjusted to resonance with the inductance, as indicated by a maximum reading on the hot wire meter. From a knowledge of the constants of the wave meter, the frequency is readily calculated. Some early rough measurements of voltage were made, using a condenser of calculated capacity, and passing current at measured frequency into it through the filament of an incandescent lamp. By comparing the brilliancy of the lamp filament with that of a similar lamp lighted by measured direct current, it was possible to secure a fairly accurate knowledge of the magnitude of the high frequency condenser current, and thus to calculate the voltage producing the current.

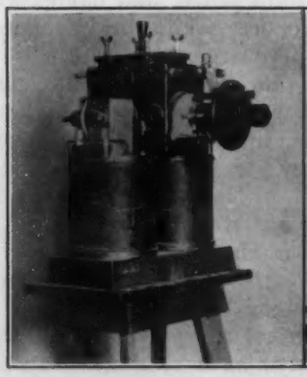


Fig. 1. 5 kw. Poulsen Arc Generator.

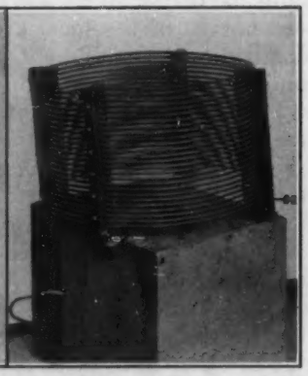


Fig. 2. Small Helix.

Steps were at once taken to provide more refined voltage measuring facilities, and some of those now available for use are, in essential parts, exactly the same as the ones used in the early rough measurements, although differing much in general appearance. However, the entire development of voltage measuring apparatus was directed toward the development and calibration of a sphere gap, constructed on the lines of the sphere gap proposed as a standard for low frequency voltage measurements by Messrs. Farnsworth and Fortescue. (See Proc. A. I. E. E. Feb., 1913, p. 299.) All other methods used for voltage measurement were but intermediate means toward this end. For a description of these means and also an account of the calibration of a 7 in. sphere gap, see paper recently submitted to the A. I. E. E. by Professor Harris J. Ryan and the writer. (This paper gives in detail also the construction and standardization of the wave meter above mentioned.) It should be noted that it is impracticable to maintain for an appreciable time the sharpness of needle points with any considerable high frequency voltage upon them owing to the melting and burning action of the coronas at the points.

The desire to increase the high frequency voltage resulted in the construction of six new helices. Each helix was wound of 25 turns ¼ in. copper tube upon hard rubber supporting posts, and the six helices were graded uniformly in diameter so as to nest inside each other. For the sake of simplicity in the connections between consecutive helices, they were at first wound in the same manner as one ordinarily winds a magnet coil: i.e., up on one layer, and down on the next, so that, if the current enters at the bottom of the first helix, leaving it at the top, it enters at the top of the second helix, leaving it at the bottom, and so forth. When, however, the nest of six helices was connected into the resonant circuit, an attempt made to excite oscillations was unsuccessful.

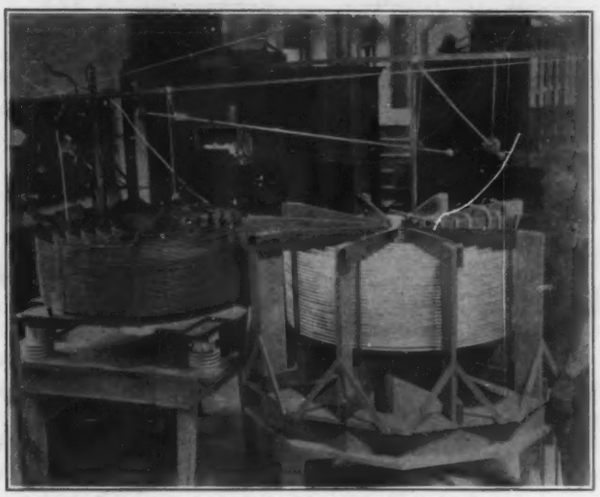


Fig. 3. Two 6-Helix Nests.

The reason for this failure of the six helix nest to excite will become apparent when one considers the broken manner in which the internal condenser of the coil was compelled to function. It will be seen that the effect of the method of connection used was to break up the nest of six helices into five subordinate oscillating circuits each having a natural frequency different from that of any of its neighbors. It is but natural that this chain of circuits should fail to function as a coherent unit.

To overcome this defective action of the coil, the turns of all helices were laid on in the same manner, and connected in such a way that the current leaving the top of helix Number 1 enters the bottom of helix Number 2; that leaving the top of Number 2 enters the bottom of Number 3, and so on. In other words, connections were made from the top of each helix to the bottom of its inner neighbor in regular order throughout. With the coil so arranged and connected, no further trouble was experienced from this source in securing oscillations at high frequency. A study of the distribution of potential through the nest of helices will now show that the source of trouble is removed by this new manner of connection. The nest no longer functions as a series of somewhat unrelated minor circuits but now possesses unity of action. It should be noted that this method of connection also prevents undue concentration of the electric field at any place by a uniform and easy grading of the potential through the nest of helices. Thus local corona has been eliminated at any voltage the helices have yet been called upon to generate.

Another nest of helices has since been built. This second nest is wound of flat magnet wire and is insulated with paraffined oak sticks. It is made as nearly an exact duplicate of the first nest in dimensions as possible, but the difference in the conductor section made the length of winding in the second set slightly greater than that of the first. The length of this second set of helices is 14 in. The diameters of the 6 helices of the set range uniformly from 41 in. down to 14½ in. The two 6-helix nests are shown in Fig. 3.

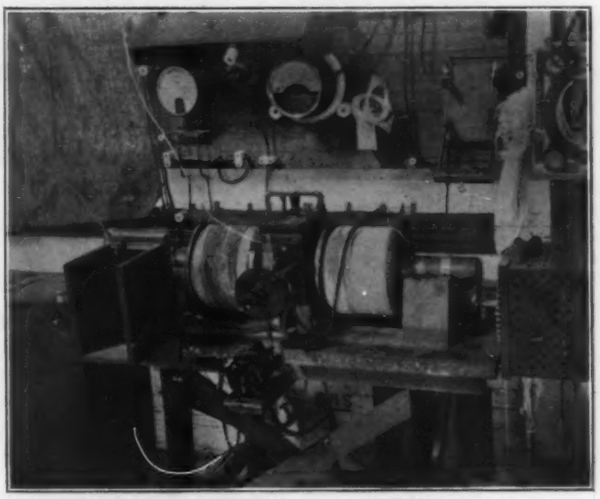


Fig. 4. 12 kw. Poulsen Federal Generator.

The limit of the capacity of the 5 kw. Poulsen generator was practically reached at the time when

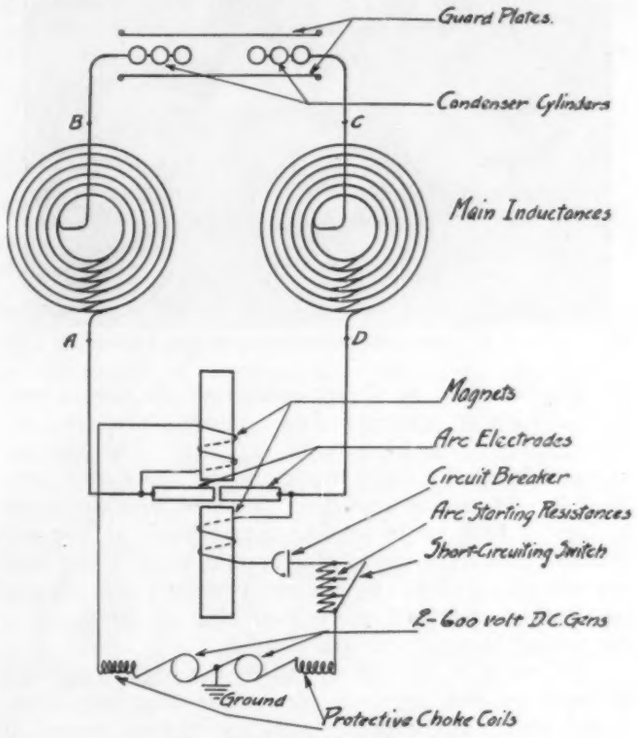


Fig. 5. Connection Diagram.

the first nest of helices was put into use, and the 5 kw. generator was exchanged for a 12 kw. Poulsen-Federal generator, Fig. 4, through the further gener-

osity of the Federal Telegraph Company. This 12 kw. generator is of ample capacity for the highest powered oscillatory circuit thus far used. The direct current for the arc is supplied by two 7½ kw., 600 volt generators in series with their mid-point grounded.

Fig. 5 is a connection diagram of the apparatus as normally operated. It will be noted that the inductance of the oscillatory circuit is evenly balanced with respect to the capacity, and it has been found that this is essential to securing free oscillations throughout the range of frequencies employed, although there appears to be freedom of oscillation at certain frequencies when all of the main inductance is connected in one winding. The guard plates shown at the top of Fig. 5 are used to keep the strong electrostatic field of the condenser within narrow bounds, thus preventing possible injury to the insulation of neighboring apparatus. These plates are insulated from ground, but they normally "float" at approximately ground potential.

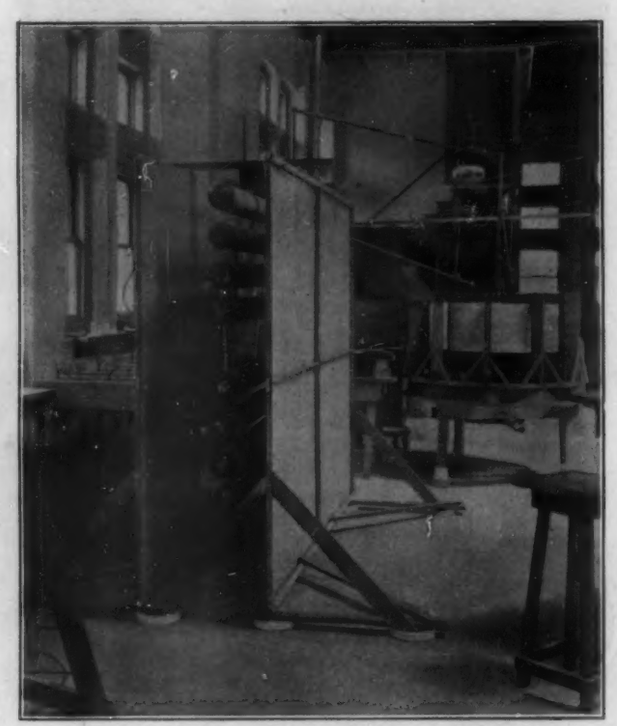


Fig. 6. Main Condenser With Guard Plates.

Fig. 6 is from a photograph of the main condenser with its guard plates. These plates are approximately 7 ft. high by 9 ft. long. The electrostatic field of the main inductance is quite well confined by the simple expedient of connecting the outer helices of both nests so that they remain at low potential. Thus, the turns which are at highest potential are not only guarded by the outer helices, but are also of smallest area and hence least able to throw out a disturbing stray electrostatic field.

When it is desired to utilize the high frequency voltage for any purpose such as testing insulation, connection may be made in either of two ways. If this voltage is tapped from points BC, Fig. 5, the maximum voltage developed in the oscillatory circuit is available, but under the disadvantage that a short circuit of the main condenser by failure of the test specimen means also a short circuit of the 1200 volt d.c. source, thus opening the circuit breaker. On the other hand, in cases where half of the high frequency voltage will suffice for test purposes, connection may be made at AB (or CD). This connection possesses the marked advantage that a failure of the test specimen can do nothing more than short circuit one of the two main inductances while the main condenser prevents short circuiting of the d.c. source. The oscillatory circuit is thus immediately "put to sleep" as the arc is incapable of exciting the latter circuit without a readjustment of arc length to accommodate the changed inductance.

ELECTRICAL DEMONSTRATIONS.

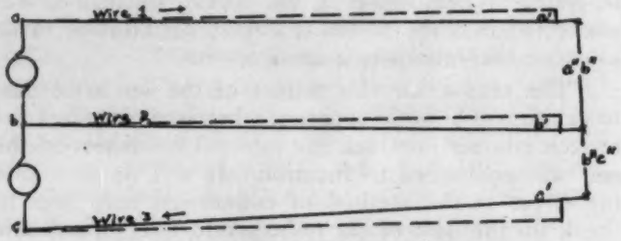
BY E. L. ARNOLD AND D. B. MUNROE.

(These demonstrations for class room work were presented as a thesis to the University of Southern California for the degree of Bachelor of Science in Electrical Engineering, and delivered as a paper at the last meeting of the Los Angeles Section, A. I. E. E., by the authors.—The Editor.)

Proposition II.—Voltages on 3-Wire System.

The object of this experiment is to graphically show voltage at any desired point on a 3-wire system with various assumed loads.

The generators are assumed, for convenience, to be connected in series and so that the positive brushes are connected to wire (1) so current will always flow in wire (1) away from the generator. Then this will necessitate that the negative terminal will be connected to wire (3) and so current will always flow towards the generator in wire (3).



Graphic Representation of Voltages on 3-Wire System.

"Electric current may always be considered as flowing down hill so that the electric level (or potential) is to be thought of as falling off along each main in the direction of the current." So the wire (a a′) will always assume some position, determined by the resistance of the wire it is representing and the current flowing in that wire, lower than the original or no drop position. The same reasoning can be applied to wire (b) with the exception that the point (c) must be moved upward since that end must be higher than end (c) to allow for the drop alongthat wire. The distance (a′) is to be moved is determined by the resistance of line represented by (a a′) and the current flowing in (a a′). The product of these two will give voltage drop along (a a′). Then point (a′) will take a position corresponding to this voltage drop as indicated by scale.

The same is true of the point (c′) which will be moved upward an amount equivalent to the product of the resistance of the wire and the current in it as indicated on the scale.

The point (b′) will be moved either up or down; the direction to be determined as explained before, by

the amount corresponding to the product of its resistance and the unbalanced current which is flowing in it.

After these new positions of (a′ b′ c′) have been obtained the voltage which is applied across the load can be obtained by reading from the scale the voltage corresponding, in one case, to (a″ b″). This is the voltage across the load between wire (1) and (2). The voltage between the wires (2) and (3) is obtained in a similar way by reading the voltage indicated on the scale between the new positions b of (b′) and (c′) or the distance (b″ c″).

The movement of wire No. (2) is determined by the direction of unbalanced current. If the unbalanced current flows towards generator, or current in (1) is greater than (3), (b′) moves up. If reverse is true, that is unbalanced current flows away from generator or current in (3) is greater than current in (1), (b′) moves downward from mid position (2). By varying the loads between the wires (1) and (2), and (2) and (3) different positions of (a′ b′ c′) may be obtained and the result of this varying can be seen at a glance from the apparatus.

The effects of great unbalancing of the load can also be readily seen and the reason for the possibility, which appears at first thought to be impossible, of having a greater voltage, say for example, across (a″ b″) than is delivered to those lines by the generator across (a b).

All the numerical problems pertaining to the voltage drop and characteristics of unbalancing loads on the three-wire transmission can be readily shown by means of the operation of this simple apparatus.

The scope of the apparatus can be increased by having several boards similar to (a′ b′ c′) and placing each at the point corresponding to where another load is and so by placing scale between line (a) and (b) or (b) and (c) the voltage of any point on the system can be readily determined.

Steam for atomizing oil should be dry to produce a steady white flame. Water in the steam, usually due to condensation in the supply pipe or priming of the boiler, makes the flume sputter and gives poor combustion. A steam separator or a superheater will stop the trouble.

An oil storage tank should be placed at least 2 ft. underground and 30 ft. from the nearest building, with the top of the tank below the level of the lowest pipe in the oil system. If the tank is placed above ground it must be at least 200 ft. from inflammable property to comply with the underwriters' requirements.

The "televista," seeing by wire, is a contrivance recently invented by Dr. A. M. Low of London, with which it is claimed that light may be transmitted by wire. A screen of selenium cells over which is passed a high speed motor-driven synchronously running roller consisting of alternate conductors and insulators is used as a transmitter. As selenium is sensitive to light the resulting variations are tranmitted over wires to the receiver, which reproduces a flickering image by means of a similar series of selenium cells affected by the passage of polarized light through thin slats of steel.

HOW COMMISSIONS REGARD UTILITIES.

BY H. D. LOVELAND.

(This paper is in a measure a sequel to that by John A. Britton, published in these columns last week. Mr. Britton's article dealt largely with the subject of how public utilities regard regulation while Col. Loveland's paper tells how regulatory bodies regard public utilities. The author is a member of the California Railroad Commission and spares no terms in his denunciation of frenzied finance. Both talks were originally presented before the Civic Club of San Francisco. It has been slightly condensed for publication.—The Editor.)

Our opinion of public utilities today is largely the result of our experience with them, and obviously is not one that can be applied universally. Each experience with a public utility naturally gives birth to an opinion concerning that utility and any opinion expressed in general terms must be based upon the aggregate of these experiences. Such experiences have been many and varied.

When the public utilities act became effective and the real work of the commission began, there was —as was told you by Mr. Britton—a period of doubt and uncertainty on the part of public utilities. Few of them favored regulation, and those who did were in doubt as to the operation of the act under the interpretation of the California commission. Managers sought information and law departments were kept busy defining their employers' rights under the act. Their doubts, however, were soon resolved. So far as practical, rules and regulations were promulgated by the commission, which before adoption were quite generally considered at conferences between the commission, representatives of utilities and of the public. Recognition of the fact that regulation as comprehended by the public utilities act and as that act found its interpretation through the activities of the railroad commission, meant recognition and protection of the rights of public utilities as well of the people, was soon apparent, and regulation in California became an accomplished fact without serious friction. Naturally, our opinion of public utilities changed with these changing conditions.

I say that regulation became a fact in California without serious friction and that reservation is necessary. All managers of public utilities are not like Mr. John A. Britton, and all public utilities are not like the company which he represents. It is of record in the annals of our work that we were compelled to say, and did say to the president of one of the largest public utility corporations in the state that unless the reasonable requirements of the commission were observed and complied with, some one would be arrested and that it would not be a subordinate. In some instances the commission found it necessary to fine public utilities to enforce its orders and it has not hesitated to do so.

One matter, which is worthy of mention, is the disposition on the part of some public utilities to make the commission a scapegoat, so to speak. If their employes ask for an increase in wages, they are told that owing to the reduction in their income by the railroad commission, they are unable to do as they would otherwise like to do. As to almost any request which they do not want to grant, they find reason to blame the commission for their inability to grant it. This disposition is also shown by the following:

Notwithstanding the fact that the public utilities act provides who may receive free transportation upon approval of their request for same by the commission, and that the Commission in approving such requests is bound by the terms of the Act, transportation companies have frequently given as a reason for not granting transportation asked that the Commission would not permit it. Naturally, these things color our opinion of public utilities. It is only human that they should, but in simple justice to the Commission, I want to assert with all of the earnestness and emphasis at my command, that they in no way effect adversely our fair and reasonable treatment of public utilities.

Recognizing the responsibility of the great trust reposed in us, in the discharge of the duties of our position, we are actuated by but one motive, and that is to be right—fair and right to the people and to the public utilities and to clothe our work with that dignity which its importance warrants. In the language of that greatest of all American statesmen:

"With malice towards none and with charity for all, we seek to do the work as God gives us to see the right."

Mr. Britton told us that recognition was born of necessity. In that he uttered a great truth. He might have gone further and told you that all reforms are born of want and necessity. This great truth is as old as civilization. It was true when the Paladins of Charlemagne beat back the hordes of barbarians and saved to the world the remaining spark of civilization, which had steadily waned for 400 years. It was true when the Barons exacted the Magna Charta from King John, and it was true when this Republic—time's noblest offering—sprang from the womb of ages. It was true when the great emancipator struck the shackles from the limbs of 3,000,000 human beings and removed the foul blot of slavery from this earth's fairest civilization. Coming down to the immediate past, it was true when time, pregnant from the embraces of want and necessity, gave birth to the progressive movement in California and called the great leader of that movement into public life. It is true today and it will be true while the eternal hills shall stand.

Regulation of public utilities was born of necessity and that necessity in the very nature of things will continue. If any argument is necessary to convince you of the fact, Mr. Britton made it when he told you that a public utility with which he was connected some years ago with an investment of $1800 made in a few years a million of dollars. It may well be assumed that that experience taught him, or helped to teach him, the necessity for regulation. If any further argument is necessary, let it be found in a statement made by Mr. Mellen of the New York-New Haven and Hartford Road, which appeared in the San Francisco "Examiner" June 7th:

"There is no lesson more clearly taught by history," says Mr. Mellen, "both business and political history, than the lesson that absolute power will be abused by 99 in every 100 men. The very selfishness which nature implants in us to stimulate our desire for progress makes it inevitable that we will abuse great power over other people when we have it. Probably the public does not realize that during the last 50 years, the stockholders of these great corporations have suffered even more than the public from the license which the managers and outsiders, who controlled the managers of these corporations, have enjoyed."

Mark you, he says. "The license which they have enjoyed," and when you remember that the stock and bonds of these corporations are largely held by the public, it must be evident to you that some regulation is necessary to prevent the exercise of such license.

But it was not the John Brittons and the Jesse Lilienthals who made regulation of public utilities necessary. It was men of a different sort. Managers and directors, who believed, and still believe in what they regard as the divine right of wealth to exploit the many for the benefit of the few, and in the ranks of public utility directors and managers there are many such; and were it not for regulation, for every Britton and every Lilienthal, there could be found a dozen Mellens and a score of Calhouns, who would be willing to nail to the masthead the slogan "The Public Be Damned," and sail their ship in any sea on any course where profit was greatest. These are the men who object to regulation. And so I say, regulation must continue; continue along conservative, sane and reasonable lines, and never for a moment should regulatory bodies lose sight of that cardinal truth that regulation and prosperity should go hand in hand.

Capital will not and should not be expected to risk investments in public utilities and receive only such returns as may be had from mortgage investments. Returns should be liberal, and in building up public utilities when the risk of loss is great, the returns upon the investment should be correspondingly large. Also reasonable promotion fees should be recognized and allowed in the origin and development of public utilities to the end that the intelligence of those who possess the power of initiative may may be used for the progress and development of our country. Such has been the earnest endeavor of the California Commission. Yet, in justice to the Commission, I must add that we also take into consideration the question as to whether the promoters of public utility enterprises are willing to risk their own money, or whether they desire to borrow the entire investment from the public through bond issues and then expect the public to pay such rates as will enable them to meet bond interest and put aside a sinking fund to retire bonds at maturity, while they own the property thus developed through stock ownership. This has been an attractive method of financing public utilities in the past and all too often such enterprises—capitalized without restriction—have been forced into reorganization to the material loss of those who invested in their securities.

To epitomize the position of the Commission briefly, I desire to quote from a decision recently issued by the Commission:

"For what happened before the Public Utilities Act became effective, the Commission is not responsible. The most that the Commission can be expected to do now is to see that by none of its acts does the condition of utilities become worse than it was before March 23, 1912. When a utility which has been improvidently and recklessly financed prior to March 23, 1912, comes before this Commission, the Commission will seek to compel the utility to better its financial condition instead of making it worse. And while the Commission must perforce permit for a while many conditions to continue which it would never have sanctioned initially, it will constantly strive to bring public utility financing more nearly to the level which it should have assumed from the start."

Frequently also through misconception in the beginning of what could be accomplished, or through mismanagement, public utilities fail to produce returns upon investments and holders of security lose. Such failures create mistrust in business and financial circles, with the result that the injury they cause cannot be measured by the pecuniary loss of those who hold securities in such utilities.

This brings me to another matter that I especially want to call your attention to. As you are aware, we are experiencing a period of financial depression, which though seemingly wholly unwarranted, seems to recur with more or less regularity in this and other lands. Probably every man within sound of my voice can recall one or more such periods. In the past, tariff legislation or currency reform movements have been popularly assigned as the cause of such periods. Today regulation of public utilities is being blamed, although we have never seen more drastic tariff and financial legislation than has been enacted during President Wilson's administration. All of this has been, and is being, ignored by the public utilities which are desirous of moulding public opinion adverse to regulation. Already there are whispers that regulation is hurting business in California. Already the Interstate Commerce Commission is being criticised in the columns of papers and periodicals—such utterances in my judgment being inspired by directors and managers who do not take kindly to regulation. The reason is obvious to any thoughful mind, coming as these utterances do at a time when the Federal Commission is considering the request of the interstate carriers for a horizontal increase of 5 per cent in freight rates. It may be that owing to the alleged increase in the cost of operation, which, however, is not admitted by some, and the reduction in rates by Commissions, some increase in transcontinental rates is really justified, and if so, it should be granted. The prospertiy of our country is indissolubly bound up with and dependent upon the prosperity of our great arteries of transportation, but there are two things I want to call your attention to in this connection.

Of one premise I am perfectly sure, and that is—that instead of regulation having caused the present financial depression, it is the result of lack of regulation in the past, the reckless inflation of values and the issue and sale of watered securities upon which returns cannot now be paid; in other words, the gross and often dishonest management of public utilities, which proper regulation would have prevented. The other thought is that if trust-made and trust-controlled merchandise were compelled to pay the same rate of freight that the people pay generally, the necessitiy for an increase in rates might not be as keenly felt.

Referring again to the fact that regulation is being blamed and will be blamed for hurting business and bringing about hard times, let me remind you that recurring periods of financial uncertainty and resulting depression in business activities, or what is familiarly known as "hard times," were a part of the history of this and other countries long before regulation of public utilities was known.

Instead of regulation hurting business, and particularly the interests of public utilities, let me cite two instances which have recently come within the knowledge of the Commission, that regulation is a help rather than an injury: Recently a representative of a large bond house in this city came to the Commission and showed us a letter which his firm had received from one of the great bond houses of London. In the letter occurred this paragraph:

"Please obtain for us whenever possible California securities which have been approved by the Railroad Commission of California."

Another instance occurred in connection with what is known as the "Oro" case. The Western States Electric Company was serving the City of Stockton with electric energy and an application was received from the Oro Electric Company for a certificate of public convenience and necessity to enter and serve the same city. After an exhaustive investigation and hearing, the Commission denied the application of the Oro Electric Company on the grounds that public utilities should be protected when giving efficient service at reasonable rates. The case was appealed to the Supreme Court and that august body overruled the decision of the Commission. The following morning a telegram was received from one of the large bond houses in New York asking the Commission to give them the status of the case, as California securities had been very attractive under the ruling of this Commission, but that if the position taken by the Commission that utilities should be protected as well as regulated was not to be approved by the courts, California securities would be less attractive.

Just one word more as to regulation injuring public utilities. I shall not mention names, but you will readily understand the utility to which I refer, for the reason that it has been much in the public eye recently. A utility which cost $20,000,000, immediately capitalized for $80,000,000, with an earning capacity of $8,000,000 and expenses of approximately $4,000,000, was compelled to apply to the Commission for permission to issue notes or equipment certificates to procure necessary equipment. Do you think for one moment that that utility, under wise and reasonable regulation, would have found itself in that position? Your answer springs unbidden to your lips, and I feel assured that you will say as I do that it was the lack of regulation and the frenzied methods of finance resulting from such lack of regulation that prevented that utility from having ample means to thoroughly serve the public and pay handsome dividends upon legitimate capitalization.

I must apologize for straying away from my text, but all of these thoughts really have something to do with our opinion of public utilities. To sum up, then, we regard public utilities as necessary to the growth and development of our complex twentieth century civilization. We believe that regulation and protection should be concomitant and that public utilities should be fostered, protected and regulated when necessary.

Fuel oil strainers, made of wire netting or perforated metal, are necessary to insure that the burners are not clogged by sand or dirt in the oil. They should be made and put in so that they can be quickly and easily cleaned.

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ON LIBRARY CARS OF ALL SOUTHERN PACIFIC TRAINS

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The Water That Goes Down to the Sea

Nature endowed this west coast of America with great mountain ranges whose lofty peaks condense the moisture raised by the sun from the sea and give opportunity for the water to again go down to the sea. For countless ages this continuous cycle was commercially useless. Here was pristine nature, the passive factor in production, an aggregate of materials and blind forces, destroyed as readily as created.

Enter man, the active factor in production. By brawn and brain he marshalled the materials and directed the forces. He employed the water to wash the gold from the gravels in the high lands, then to irrigate the soil in the low lands, and later to turn the wheels of industry. Thus were the two primary factors of production conjoined to increase the utility of water.

Finally came capital, the resultant of these primary active and passive forces, the product of past industry, first aid to future production.

But because capital is thus a secondary factor, certain would-be reformers, ignorance alike of the fundamental principles of mechanics and economics, are trying to destroy this secondary of the transformer which steps up industry to wealth. Its flow through normal conductors has been checked and as a result labor is idle, material useless and production stopped.

The Oregon Hydroelectric Commission conservatively estimates that at least three million horsepower is running to waste in that state because its other natural resources have not yet been developed by capital. Here is a territory capable of supporting millions of prosperous people if capital can be attracted.

But what are the facts? Capital is being repelled, when not destroyed, by restrictive legislation and governmental competition. Water power development is being discouraged. Although past evils have been corrected, yet the pendulum is being swung still further to the nether extreme. Surely the time has come to cease the persecution of capital and to utilize the water which is now uselessly going down to the sea.

Another Record Breaker

The laying of a second power cable across San Francisco Bay sets another record for the West, this being the largest and longest submarine cable in America. This last link in the 150-mile transmission of power from the Sierras to the sea was successfully completed during the past month. The Great Western Power Company has created larger storage capacity by building the Big Meadows dam, has installed new generators in the Big Bend plant, and by the completion of the cable crossing is thus able to replace fuel oil with water power for its San Francisco system.

San Francisco offers many physical obstacles to the entrance of power. Situated at the extreme end of a narrow peninsula, the first high tension transmis-

sion lines reached the metropolis by means of long detours through a region where heavy fogs and consequent troubles are frequent. An aerial crossing not only presented great engineering difficulties, but also was forbidden by the War Department. The San Francisco & Sierra Power Company spanned the bay by a tower line south of Dumbarton Point, where shallow water made concrete foundations possible. Finally the Great Western Power Company cut the Gordian knot by laying an 11,000 volt cable in 1912, which has given such excellent service as to justify this new cable.

One of the most interesting features in connection with the installation were the ingenious methods adopted by the contractor. The first cable had been spliced on shore, and required a great barge of a half million pounds displacement, together with three tugs for its maneuvering. By adopting the expedient of splicing the cable on the barge a small float and gasoline launch sufficed. The traction cable of the old Geary street road continues its useful life as the messenger for the power cable, and the barge was anchored by a cable grip from one of the old cars. The great value of the article on this subject, as printed elsewhere in these columns, are the illustrations of each step in splicing a cable, and to those interested in such work this article is commended.

Capitalization of Good Will

Good will is an intangible asset whose very vagueness vitiates its value. Because it cannot be felt, seen, heard, tasted or smelled, because it defies measurement by the yard-stick or pint cup, because it cannot be weighed in the balance, it is to be thrown on the scrap-heap as worthless. That which the individual values perhaps higher than anything else in life, the good opinion of his fellowmen, is valueless to an aggregate of individuals banded togetther for the service of their fellowmen.

Such in brief is the substance of legal decisions regarding the good will of a public utility corporation.

From time immemorial business enterprise has been rewarded by the patronage of those having confidence in the excellence of its service. Millions of dollars have been paid for businesses whose physical values—"furniture and equipment"—were but a small part of their earning power. Consider a newspaper, the practice of a professional man, or a trade-marked article of merit which has been extensively advertised. The public service corporation is denied such reward.

Good will is as an essential part of the worth of a corporation as is the spirit which actuates the body of a man—and fully as valuable. Without it, physical equipment is of small avail. It may be defined as the integral of the confidence felt by individual consumers. Confidence in turn is the first derivative of personality with reference to service. These three factors—confidence, personality and service, the basis upon which all successful businesses have been built, and the result of an expenditure of thousands of dollars in creating a favorable public opinion, are of no value to the public service corporation for rate-making purposes.

The reason assigned is that the utility is usually a monopoly; under ordinary conditions the will of the consumers, whether good or ill, makes little difference in the amount of the utility consumed; "a monopoly has no good will, for its customers are retained by compulsion, not by their choice."

So it is seen that good will must be predicated upon competition—present and active. It makes no difference how intense the competition may have been before the monopoly was formed, it matters little if other utilities are fiercely competing with that controlled by the monopoly, whether fuel oil is supplanting gas for domestic use, or the wireless telegraph replacing the established system, the good will of the corporation which has survived past competition, and holds present consumers. cannot be capitalized.

Occasionally when the shoe pinches the other foot, the public at large is made to realize the inequity of these rulings. Recently a Western city desired the use of certain valuable privileges belonging to a private corporation. In return for their use the municipal authorities offered their good will with the railroad commission. "A good thing to have," you will say—but of what worth if it cannot be capitalized? What man versed in the uniform methods of accounting prescribed for public utilities would allow such an entry on the books of the corporation? The corporation has no competition; hence its good will has no value. "Even under competitive conditions good will cannot be considered in the valuation for rate regulation," says the Wisconsin Railroad Commission.

Consequently, if the corporation is compelled to concede the worthlessness of its good will asset from a rate-making standpoint, should not the rate-making body stand as a protecting bulwark against a possible ill will liability which too frequently forces rates below a profitable level? Otherwise there is little incentive for promptness and courtesy in public dealings, voluntary reduction of rates when conditions justify, or a consideration of the welfare of employes—those factors which build up good will.

Although this feature cannot be included in the assets of the corporation for rate-making purposes, it actually constitutes a valuable part of the corporation worth when its property is for sale. Yet how easily can this good will be broken down by unscrupulous parties who might desire to depreciate the corporation's securities. So one of the chief functions which a public service commission has to perform should be that of protecting the companies which submit to its jurisdiction.

Yet the Railroad Commission of California not only disallows capitalization of good will, but even "regards with extreme suspicion" that well-recognized and established element of appraisal known as going concern value. Submitting, for the sake of argument, to the Commission's late decision regarding the unreasonableness of the rates of the Coast Valleys Gas and Electric Company, is the natural divergence of opinion regarding these intangible elements sufficient grounds for the insinuation "that the value of engineering aid in rate fixing is much over estimated, or that one or the other engineer * * * is mentally dishonest"? What say you?

PERSONALS

R. H. Ballard, secretary and assistant general manager of the Southern California Edison Company is at Lake Tahoe.

H. L. Jackman, manager of the Western States Gas & Electric Company, Eureka, was at San Francisco during the past week.

S. Herbert Lanyon, Portland representative of Pierson, Roeding & Company, has been spending the past week in San Francisco.

C. M. Means, electrical engineer, of Pittsburgh, Pa., has been appointed consulting electrical engineer with the U. S. Bureau of Mines.

Max Loewenthal, president and manager of the United Electric Stores, Inc., of Los Angeles, was in San Francisco last week on business.

W. J. Grambs, assistant to the President of the Puget Sound Traction, Light & Power Company, has returned to Seattle from San Francisco.

Wm. H. Onken Jr., managing editor of the Electrical World of New York City, is looking over the new developments in the West since his last visit.

F. H. Gale, advertising manager of the General Electric Company, Schenectady, and Miss Gale, on an extended trip of the Pacific Coast, arrived in San Francisco from Southern California during the week.

F. M. Farmer, chief engineer of the Electrical Testing Laboratories of New York City, is visiting the Pacific Coast, now being at Seattle, after visiting Salt Lake City, Los Angeles, San Francisco and Portland.

C. V. Schneider and **J. C. Rendler** have been appointed directors of the California State Contractors' Association, and are to represent the association at the National Contractors' Association convention, Detroit, July 15-18.

S. J. Lisberger, engineer of electrical distribution, and **F. H. Varney,** steam-electric engineer of operation, Pacific Gas & Electric Company, have returned to San Francisco from the N. E. L. A. convention at Philadelphia.

F. W. Emery, A. M. Roberts, W. A. Morey and **L. A. Porter** have been appointed by the city of Lewiston, Idaho, as a power plant board to investigate the question of securing a site on Clearwater river for a municipal power plant.

H. B. Squires, of the firm of H. B. Squires Company, San Francisco, has left for a month's trip throughout the East, during which he will visit the various factories he represents and expects to make the return trip by way of the Northwest and Portland.

A. M. Hamblett, chemical engineer with Whitney & Company, Boston, who has been in California for some months, in connection with the Electro-Alkaline Company's plant in Oakland, leaves for Sweden shortly, on business for the Boston concern.

Jos. M. Berkeley has been appointed superintendent of the gas department of the Southern California Edison Company of Los Angeles, succeeding **H. W. Burkhart,** who recently resigned to take up private practice as announced in these columns.

H. E. Sanderson, Pacific Coast manager of the Bryant Electric Company has just returned to San Francisco after an extended business trip of several weeks through the Northwest, including Portland and Seattle. Mr. Sanderson reports brighter business conditions in this section.

Prof. James G. Scrugham has been appointed dean of the department of engineering at the University of Nevada. This newly created department includes the colleges of mining, electrical, mechanical and civil engineering. Prof. Scrugham has also been appointed special commissioner in charge of the Nevada exhibits at the San Francisco and San Diego expositions.

Edward A. Quinn, formerly representative of the Allis-Chalmers Company, has been appointed to fill the vacancy in the position of general superintendent of the San Joaquin Light and Power Company recently caused by the tragic death of **L. N. Peart.** Mr. Quinn has had a wide and varied experience in electric construction and operation, having been associated from time to time since 1893 with the Chicago Edison Company, the Edison Light and Power Company of San Francisco, the Standard Electric Company of California and the Nevada-California Power Company, with which latter concern he was general superintendent from 1907 to 1910. Furthermore, his experience with the Westinghouse Electric and Manufacturing Company and the Allis-Chalmers Company have eminently qualified him for his present position, in which his many friends join in wishing him success.

John Sandberg, special appliance salesman of the General Electric Company, has returned from a month's work in Idaho, where he has been co-operating with **Julius Derge,** in charge of appliance sales for the Utah Power & Light Company, in an extensive selling campaign of electric ranges and cooking appliances. They visited practically all of the important towns on the Utah Power & Light Company's system in southern Idaho and carried with them a complete equipment which was set up at some convenient store or hall, for demonstration purpose. Their coming had been extensively advertised by the company's local representatives and the patrons from the town and from the surrounding territory came in great numbers to witness the demonstration. Messrs. Derge and Sandberg express complete satisfaction with the results secured. A great many orders were taken for ranges and for heating and cooking appliances and much interest was stimulated among the well-to-do farmers, which will undoubtedly result in sales later on.

MEETING NOTICES.

Jovian Electrical League of Southern California.

The last meeting of the season of the Jovian Electrical League of Southern California was held at Christopher's on June 24th, and in accordance with tradition, was attended by about 150 loyal Jovians. The meeting was in charge of L. S. Granger, and after the rendition of a splendid musical program, a talk on "Personal Efficiency as a Science" was given by Dr. Charles W. Hall, the Pacific Coast representative of the American Institute of Efficiency. Dr. Hall gave a very practical talk on business efficiency, citing as a slogan the words—"Analyze, don't guess." He said that the difference between the former scientific manager and the present efficiency expert is that the former tried to squeeze profit out of labor, while the latter takes into account the human equation. Dr. Hall enumerated the following essentials in applying efficiency methods: Records, Planning, Schedules, Despatching, Standardizing Conditions, Standardizing Operation, Common Sense, Competent Counsel, Fair Dealings, Discipline, Efficiency Reward.

He laid great stress on the statement that procrastination, besides being the thief of time, was also a slayer of character, and that to make good use of one's twenty-four hours differentiates the efficient man from the hobo. He claimed that there was no doubt that the successful man is efficient, and the efficient man generally successful. In quoting Mr. Harrington Emerson, he said in conclusion, that there is no obstacle so great that there isn't some way around it, or under it, or over it, or straight through it.

The Jovians then elected Mr. Dick Alter of the Edison Company and also of the Garrick Theater, an honorary member of the League, and appointed him the official Jovian pianist.

TRADE NOTES.

The board of public works of Seattle has awarded to the Allis-Chalmers Company a contract for furnishing transformers at a cost of $10,500.

W. R. Pounder, Pacific Coast manager for Hubbard & Company, has removed his offices from the Williams Building to 401 Rialto Building, San Francisco.

H. N. Lauritzen, Pacific Coast manager for the Holophane Works of the General Electric Company, reports an increased business for the past month, which usually mark a decline coincident with the summer season of small lighting business.

The East Oregon Lumber Company has purchased 120,000,000 ft. of timber in the Wallowa national forest from the government A mill will be erected at Enterprise and a tap line railroad is to be constructed at once. C. D. Logan is to have charge of operations.

The Power Equipment Company, Rialto Building, San Francisco, have been awarded the contract for the Sacramento Sewage plant No. 2. The electrical equipment will be of General Electric Company manufacture and the pumping equipment will be supplied by the Worthington Pump Company.

The Portland Gas & Coke Company has awarded the contract to the Camden Iron Works, of Camden, N. J., for the construction of a gas holder to be built on Milwaukee and Clinton streets. The structure will have a capacity of holding 2,000,000 ft. of gas and will be the largest in Portland. The entire structure will be of steel with the exception of the concrete foundations. It will be 150 ft. in diameter and 175 ft. high. The cost is placed at $30,000.

Eardley Bros., the enterprising firm of electrical contractors of Salt Lake City, had as their guests the employes of their company at a strawberry and dancing festival Thursday evening of last week. The company slogan, "Let Eardley Bros. Do It If You Want It Done Right," is an ample guaranty that the evening was a most enjoyable one. Further evidence could be secured from any of the company's employes who voted the affair a highly enjoyable one.

The new substation of the California-Portland Cement Company at Colton, Cal., is nearing completion. The building is of concrete construction and is thoroughly modern in every particular. Three 1500 kw. transformers are to be installed in this station to take the place of the three 800 kw. now in use at this plant. There are also motors totaling approximately 2500 h.p. now on the ground which are to be installed in the immediate future to supplement the present equipment.

The Southern Pacific Company has given The Electric Storage Battery Company of Philadelphia an additional order for 650 sets of "Ironclad-Exide" Batteries for locomotive head-light service. With the previous order received several months ago, this makes a total of 946 sets—2838 cells—of Type 13 MV "Ironclad-Exide" which will be used in this class of service by the Southern Pacific Company. The ruggedness of this type of battery, its long life and the fact that it can be operated for much longer periods without cleaning than any other type, make this battery peculiarly adaptable to the severe service requirements in this class of railway work.

The General Electric Company has recently issued Bulletin No. 41302, which covers the complete line of G-E Standard Polyphase Induction Motors. The characteristics of the different forms of these motors are analytically described, and the windings used for various classes of service are shown. Every effort has been made to include information which will be of value to the operator of G-E motors, and dimension drawings of motors and compensators are shown. Bulletin No. 46201 illustrates and describes the Type I-14 Single-Phase Watthour Meter for which is claimed high initial and sustained accuracy, wide range of capacities and low cost.

The Pacific Power & Light Company has obtained contracts to furnish power to the two large dredging companies which will soon begin operations near Astoria, Oregon. These companies are the Tacoma Dredging Company of Tacoma, Wash., and the Standard American Dredging Company of Oakland, Cal. These two projects are known as the "Reclamation" and the "City" contracts. Each company will use 600 kw. of energy delivered at 2300 volts. The Hammond Lumber Company will install a 1000 kw. General Electric steam turbine and generator to furnish this power. The Pacific Power & Light Company buy the power wholesale from the Hammond Lumber Company and retail it to the dredges.

The Westinghouse Electric & Manufacturing Company reports the receipt of the following orders from the Pacific Coast: Pacific Gas & Electric Company, San Francisco, Cal., 1-1000 kw., 650-volt, 6-phase, 60-cycle, 600 r.p.m. rotary converter; 5-1000 kw., 650-volt, d.c. generator on common base and shaft with 5-1440 h.p., 11,000-volt, 3-phase, 60-cycle, 514 r.p.m synchronous motor. Northwestern Electric Company, Portland, Ore., 1-75 kw., 125-volt generator on common base and shaft with 1-2200-volt, 3-phase, 60-cycle, 1170 r.p.m. induction motor, and 1 switchboard for same. Pacific Gas & Electric Company, Oakland, Cal., 1-1000 kw., 600-volt generator on common base and shaft with 1-1440 h.p., 11,000-volt, 3-phase, 60-cycle, 514 r.p.m. synchronous motor generator. Pacific Light & Power Corporation, California, 2-500 kw., 2 bearing, synchronous motor generator sets consisting of 2-500 kw., 225-112½-volt, 3-wire commutating pole generators, 500 r.p.m. mounted on common base and shaft with 2-720 h.p., 3-phase, 50-cycle, 2400-volt, 500 r.p.m synchronous motors.

The San Francisco & Oakland Terminal Railways have placed their order for a new ferry boat to run between San Francisco and Oakland, with the Moore & Scott Iron Works. The general dimensions of the new boat are to be: 230 ft. long over all, 218 ft. between perpendiculars, 63½ ft. beam over guard, 42 ft. beam moulded, 19½ ft. depth moulded. The hull is entirely of steel and will have six water tight transverse bulkheads, and two longitudinal bulkheads, making the vessel non-sinkable in case of collision. The boat is designed to carry from 2500 to 3000 passengers. The machinery will consist of compound engines with four cylinders; two high pressure, 20 inches diameter, and two low pressure, with 42 in. diameter, all with a common stroke, 28 in. The vessel will be fitted with four B. &. W. water tube boilers, with Moore & Scott oil burning system. The vessel will have a speed of fifteen miles per hour. She will be built at the Moore & Scott ship yard, Oakland harbor, at a cost of $305,000, and will be ready to take her place on the bay run on March 26, 1915.

The municipal fire alarm department of Portland, Oregon, is installing a complete "Semaphore System" on the intersection of the streets where the greatest congestion of traffic exists. All of this aparatus is operated by a keyboard in the fire alarm central station. When a fire alarm is sent in the "semaphores" are operated and an arm with the word "FIRE" is extended into the street at the same time a bell or horn is operated, calling attention to the extended arm. In this way the fire department apparatus obtains a clear right of way which saves a great deal of time. The control circuits are operated by 28 volts from the fire alarm storage battery. The energy for operating the mechanism in the semaphore posts is a.c. or d.c. 110 volts., taken from the lighting system. At present only 7 equipments have been purchased, the same being of 3 manufacturers. The purpose being to select the best of these equipments in order to purchase the balance of the equipment. At present the equipment installed are as follows: Union Switch & Signal Company, d.c. and a.c. equipments; General Railway & Signal Company, d.c. and a.c. equipments; Hall Switch & Signal Company, two d.c. and one a.c. equipments.

NEW CATALOGUES.

Gas Engines are fully dealt with in a beautifully illustrated descriptive catalogue published by the National Transit Company, Oil City, Penna.

The Western Electric Company has issued an attractive publication entitled "The Making of the Voice Highways," which is descriptive of the manufacture of lead covered telephone cable.

Pawling & Harnischfeger Company, Milwaukee, Wis., has issued Bulletin 301A, to show the application of the Electric Hoist in the industrial handling of such materials as paper, pipe, plates, etc.

Steel-Tape-Armored Cables are described and much interesting information given regarding same in Bulletin No. 680-1 now being distributed by the Standard Underground Cable Company, Pittsburg, Pa.

Wagner Electric Manufacturing Company is distributing a handsome calendar, printed in colors and depicting the satisfaction of a boy in inspecting a Wagner motor. It bears the trite and appropriate cover "What is so rare as a day in June, for a new calendar."

Dielectric Manufacturing Company of St. Louis, is distributing a booklet of "Data on Dependable Insulation." The contains curves, tables and descriptive details of the several kinds of varnishes, compounds, and other insulating materials which this firm manufactures.

The Standard Underground Cable Company of Pittsburg, Pa., has published a condensed folder on Standard Wires and Cables, and Cable Accessories. The bulletin is handsomely printed in colors, and gives information of particular value to those interested in underground distribution.

"Western Electric Inter-Phones and Accessories" is the title of an attractive bulletin from the Western Electric Company. Descriptive details and prices are given of many types of intercommunicating telephones for office, industrial and home use. The diagrams are an interesting and valuable feature of the bulletin.

Bulletin 105, Wagner Electric Manufacturing Company of St. Louis, is devoted to central station transformers. Details of construction are graphically shown by pictures, and clearly portrayed by text. Valuable directions for core loss tests, copper loss, temperature rise and efficiency, are given. This bulletin constitutes a valuable text for all interested in transformers.

Porcelain and Glass Insulators are thoroughly described and illustrated in Catalogue Section DS845 just issued by the Westinghouse Electric & Manufacturing Company. The booklet gives a large number of sectional drawings with the voltage ratings. The different kinds of insulators such as the pin type for poles, pin type strain insulators, transformer bushnigs, roof entrance bushings, outdoor type transformer bushings, floor and wall tubes and knobs are all covered.

Publication No. 1531 from the Westinghouse Electric & Manufacturing Company, is concerned with Westinghouse Wicker-Type Electric Linotype Pots. Illustrations are given of installations, and details of construction and operation are shown. Folder No. 4277 from the same company, entitled "Drawing the Crowd and Keeping It," shows the use of Westinghouse flame carbon arc lamps, Cooper-Hewitt A. L. rectifier outfits, Westinghouse electric fans and ozonizers in meeting this purpose for moving picture enterprises.

The Westinghouse Electric & Manufacturing Company has recently issued Section 3164 covering Motor-Driven Laundry Machinery. This forms one of the series of publications which this company is now issuing dealing with motor drive as applied to various industries. The booklet is well illustrated, describes the qualifications necessary for motor drive in this class of work, and shows a number of installation views. A number of installations are also described showing the amount of power required for the various machines and also the monthly consumption of different plants.

BOOK REVIEWS.

Electricians' Wiring Manual. By Frank E. Sengstock; 406 pp.; 4½x6½ in.; 414 Illustrations; leather. Published by Popular Electricity Publishing Company, Chicago, and for sale by Technical Book Shop, San Francisco. Price $1.50.

Of the many books on electrical contracting this text comes nearest to the ideal of a simple, practical, working set of directions on how and why to wire an interior job. The author is electrical inspector with the Chicago Board of Fire Underwriters and displays a thorough knowledge of the practical details of electrical contracting. The descriptions and directions are so plain that the rawest apprentice can follow them, yet the experienced master electrician will find many new hints and kinks of value. The book has twenty-seven chapters, the first part being concerned with tools and materials and their use in wiring typical jobs. The chapters on estimating and specifications are especially good. The usual tables and formulas are given, simplified explanation of electrical theory and some excellent suggestions on wireless telegraph installations. The last, but not least of the excellent features is a complete index.

Oil Fuel for Steam Boilers. By Rufus T. Strohm; 145 pp. 4½x7 in; cloth. Published by McGraw-Hill Book Co., New York and for sale by Technical Book Shop, Crossley Building, San Francisco. Price $1.00.

Notwithstanding the wealth of information that has been published in this and other journals about burning fuel oil, there are few texts which give this subject adequate treatment. Mr. Strohm has compiled some of this matter in handy form in this little volume. Regarded merely as a compilation the work has been carefully and judiciously done. But in the light of practical experience this text can be greatly enlarged and improved. The treatment is confined to stationary steam boilers, and gives no details of important marine developments. Much of the material has apparently been obtained through correspondence and little knowledge is exhibited of approved Pacific Coast practice. The several subjects treated include principles, form and action of different burners, furnace arrangements, pumps, heaters, cleaning devices, storage, purchase and management. In the final estimate, its virtues outnumber its faults and the book will prove a valuable guide and reference for those concerned with the economical use of fuel oil under boilers.

The Job, The Man, The Boss. By Dr. Katherine M. Blackford and Arthur Newcomb; 266 pp.; 5½x8 in. Published by Doubleday, Page & Co., New York City and for sale by Technical Book Shop, San Francisco. Price $1.50.

In these days of efficiency and scientific management, there is no detail of business organization which is not being analyzed and classified. The authors of this text have made a signal success in employing workers for large concerns and have here summarized the results of their investigation for the use of others. While the treatment is largely based upon the work of earlier physiognomists, many facts of interest and value have been brought into convenient form. The business is not that of fitting round pegs to square holes, but of differentiating the round pegs from the square pegs and finding apertures into which each can be fitted. As the face is the spot where that which we call mind comes the nearest to the surface of that which we call matter, a scientific classification of facial peculiarities furnishes the most satisfactory index of character. The suggestion is made that hiring and firing of employes be placed in charge of a competent man or woman with sympathy, tact, observation and understanding of human nature. Full details as to the organization and conduct of an employment department are given, together with illuminating chapters on discipline, handling men, educating employes and vocational guidance. While some may doubt the full dependability of this information none can question its general value in guiding the selection of employes. As such it is a notable contribution to business literature which should be read by every employer if for no other reason than to avoid the stigma of poor management which is invariably associated with frequent discharges.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The commission has authorized the Long Beach Consolidated Gas Company of Long Beach, Los Angeles county, to use the proceeds of the sale of 1060 shares of its preferred stock for the purposes of paying a promissory note amounting to $40,000 held by the Southern California Edison Company and open accounts payable amounting to $611.99. The gas company was authorized to issue this capital stock by a decision of the commission dated May 23, 1914.

The Pacific Gas & Electric Company filed an application with the commission for authority to issue $12,500,000 of first preferred stock and $5,000,000 of its general and refunding bonds. The company proposes to sell the stock at $82.50 per share. The company asks for authority to sell the bonds at a future date at a price to be determined later. The Pacific Gas & Electric Company has taken steps to amend its articles of incorporation so as to provide for the issue of first preferred stock. The company desires also authority to convert its present issue of $10,000,000 of preferred stock into first preferred stock after July 1, 1916, at the rate of 1.025 shares of first preferred stock for each share of the present preferred stock. The new first preferred stock, which the company proposes to issue will be 6 per cent cumulative.

The Ojai Power Company has been authorized to operate an electric light, power, water and distributing system in and about Nordhoff in the Ojai Valley, Ventura county, and to issue capital stock of the par value of $19,200. The proceeds derived from the sale of this stock are to be used for new equipment and the betterment of the present system. It is made a condition of the commission's order that the stock shall be issued by the Ojai Power Company at par.

The Central California Gas Company has been authorized to issue bonds of the face value of $15,000 and common capital stock of the par value of $10,000. The bonds will bear interest at the rate of 6 per cent per annum payable semi-annually and will be secured by a mortgage executed by the Central California Gas Company to the Los Angeles Trust & Savings Bank as trustee. It was made a condition of the order that the bonds shall be issued so as to net not less than 90 per cent of their face value in cash plus accrued interest, and the common capital stock so as to net not less than 80 per cent of its par value in cash.

The commission has rendered a preliminary order in the applications of the San Francisco-Oakland Terminal Railways for permission to issue additional bonds and notes. The applications now pending before the commission ask authority to issue the following: $1,000,000 of general lien bonds to be pledged together with other collateral already pledged as security for an issue of outstanding notes; 500,000 of notes additional upon the collateral so pledged; 10,000,000 of first and refunding bonds. In rendering a preliminary order on these applications, the commission did so upon the representation that certain pressing obligations must be met by the railway company and because the physical valuation of properties now being made by the commission may not be completed before another 60 days. The obligations which the railway company desires to meet immediately include a preliminary payment of $60,000 on a new ferry boat to be used in carrying passengers from Oakland to the exposition grounds in San Francisco during 1915, and an initial payment of $100,000 on new street cars for the city of Oakland. The preliminary order of the commission permits the San Francisco-Oakland Terminal Railways to issue its promissory notes for a period not to exceed one year in a sum not to exceed $650,000. It is also given authority to issue $1,000,000 of its general lien bonds as collateral security for this issue of notes.

The San Joaquin Light & Power Corporation of Los Angeles has filed an application asking authority to renew notes totaling $139,967.13. The notes are to be renewed for a term of one year from date of maturity.

NEWS OF THE OREGON RAILROAD COMMISSION.

The Home Telephone & Telegraph Company has been granted permission to raise most of its rates in Medford, Jacksonville, Gold Hill and Rogue River to the approximate basis of $2.00 for one party residence and $3.00 for one party business instead of the $2.50 and $3.50 requested respectively. In granting the application for increase the commission said:

If the commission should grant authority for the Home Company to increase its rates to the extent prayed in its original or amended applications, Home Company would lose a large number of subscribers who are now patrons of its exchanges, without gaining any subscribers in place thereof; and the effect would be to decrease the number of subscribers connected, to diminish the value of service to the existing subscribers and not to increase the gross or net revenues of the company in proportion with the increase of rates. It is not possible, either by the schedule of rates applied for, or by any schedule which the commission can name, to yield to the company its present unduly high operating expenses, its taxes, depreciation, and any substantial return upon the investment, for the reason that any rates which would yield such return would be so large that the same would exceed the value of the service to the patrons and would be unreasonably high, and the applicant would in consequence lose so many subscribers that neither its gross nor net revenues would be increased.

With regard to the complaint brought by the city of Cottage Grove against the Cottage Grove Electric Company, the company was ordered to remedy its voltage fluctuation, to inspect incandescent lamps used in municipal lighting weekly, to replace lamps which have reached the limit of their efficiency and at all times to keep the lamps clean and in proper condition for efficient service. The complaint that over 100 kw.-hr. is too high, was dismissed until a further test has been made of its operation. Evidence shows that the combeen made of its operation. Evidence shows that the complaint that this meter charge is higher than the flat rate charge for the same service is not justified, the contrary being true.

The case of the Corvallis Independent Telephone Company vs. The Pacific Telephone & Telegraph Company, wherein an increase of rates is sought for both plaintiff and defendant, is set for hearing on July 8th at Corvallis.

Arizona Corporation Commission.

The original order of the commission in the case of the city of Tucson versus the Tucson Gas, Electric Light & Power Company, was amended to agree as regarding lighting rates and annual charges for street lighting business so as to be more just to the lighting company which had appealed in the Superior Court that the rates and charges first ordered be set aside. The new schedules are satisfactory to all concerned and the case before the Superior Court has been dismissed.

PUBLICATIONS RECEIVED.

California State Mineralogist F. McN. Hamilton announces the publication of Bulletin No. 67, "Minerals of California"—available for distribution July 1, 1914. Price $1.00. This work which is a cloth bound volume of 250 pages, has been written by A. S. Eakle, Ph. D., Professor of Mineralogy in the University of California, and is the result of many years of research and study of the minerals of the state. Each chemical group of minerals constitutes a chapter in the book, for instance, Chap. I—Native Elements; Chap. 11—Sulphides, etc. There is also an alphabetical index of minerals and one chapter is devoted to distribution of minerals by county. For each variety the following complete information is systematically given: chemical composition, crystal form, occurrence, cleavage, fracture, color, streak, lustre, hardness, specific gravity, and a description of localities in California where it is found, including in most cases individual deposit as well as town and county.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell, Secretary-Treasurer, 55 Fulton, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

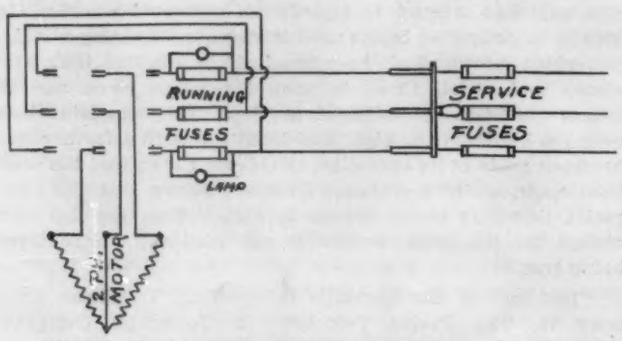
Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

A letter which fairly bristles with questions has been received, dated San Francisco, June 25th and signed E. H. The problems which it contains are as follows:

A circuit of one No. 8 and two No. 10 wires in conduit have been run from the street service to supply a 5 h.p. 2-phase, 220 volt motor. A double throw, three-pole starting switch is connected in the circuit; the switch is equipped with a spring device to prevent it from remaining closed on the starting side.



Motor Connection.

(1) Is it permissible to place fuses with rating allowed by rule No. 18 for other than rubber covered wire in the service cut-out, as the fuses at the motor protect the wires from overload?

(2) If an additional motor of 1 h.p. is installed, to what size must the service wires be increased?

(3) Sometimes an outside running fuse blows out and the motor still runs, in fact can be started with one running fuse out. How does the current find its way back to the circuit? If we connect a 220-volt lamp in parellel with each outside running fuse to indicate when fuse is blown will there be any danger from such connection?

The first question is based upon the fact that the lower limit specified for rubber covered wire in rule 18 is to prevent gradual deterioration of the high insulation by the heat of the wires and that the running fuses at the motor provide such protection; also that fuses as allowed in wires for other than rubber insulation placed in the service cut-out (one 50 amp. and two 30 amp.) would amply protect the wires from short circuit. This argument is logical and keeps continually shooting-up. The rule of the code covering this point is 23 (e) which plainly indicates that the fuses must be of the lower limit.

In answer to the second question, the adding of a 1 h.p. motor would not necessitate any increase in the size of the service wires as the present wires will transmit running current for both motors and starting current for the larger motor, while the smaller one is running. It is assumed as not probable that both motors will be started at the same time.

(3) If the motor is running and any one of the three wires is opened the motor will continue to run as a single-phase motor with a decreased efficiency.

(4) There will be no danger in connecting a lamp as described, providing it is properly connected; but the lamp will not accomplish the desired purpose as the counter current induced in the phase which may be open, bridged by the lamp, will oppose the current from the line, so that the lamp will not glow, at least not very perceptibly.

NATIONAL CONVENTION ELECTRICAL CONTRACTORS.

The annual convention of the National Electrical Contractors' Association will be held at Detroit, Mich, July 14-18. Following is a brief outline of "doings" for convention week:

Tuesday, July 14th: 9:30 a. m.—Meeting of Board of Directors and Executive Committee.

Wednesday, July 15th: Open session 10:00 a. m.

Opening of Convention—E. McCleary, Past-President National Electrical Contractors' Association.

"City of Detroit"—Commissioner John C. Gillespie.

"A Talk"—John Trix.

"Fifteen Minutes"—W. N. Matthews, Reigning Jupiter, Jovian Order.

"Workman's Compensation and Employers' Liability—Hon. John E. Kinnane, Chairman Michigan Industrial Accident Board.

Wednesday, July 15th: 12:00 noon—Complimentary Luncheon by the Detroit Jovian League to the N. E. C. A. members and their guests, Hotel Cadillac. Robley S. Stearnes, No. 1501, New Orleans, Statesman for Louisiana, Toastmaster.

Wednesday, July 15th: 2:00 p. m.—Business Session.

Address—T. I. Jones, Commercial Section, National Electric Light Association.

Wednesday, July 15th: 7:00 p. m. Rejuvenation, Jovian Order. At the Detroit Board of Commerce Building, Lafayette Blvd. and Wayne streets.

Thursday, July 16th: 9:30 a. m.—Business Session. Hotel Cadillac.

2:00 p. m.—Business Session (Continued). Speaker—S. E. Doane, Chief Engineer, National Lamp Works of General Electric Company, "Observations of Central Stations and Contractors' Conditions in Foreign Countries."

Thursday, July 16th: 7:00 p. m.—Annual Dinner, Hotel Cadillac, L. W. Eddy, Chairman.

Friday, July 17th: N. E. C. A. Birthday.

8:30 a. m.—Automobile Ride, John H. Busby, Chairman.

1:30 p. m.—Boat Trip and Outing, Steamer "Pleasure," Foot of Bates Street. Thos. M. Templeton, Chairman.

Saturday, July 18th: Business Session if necessary.

Board of Directors' Meeting following Business Session. Executive Committee Meeting following Board of Directors' Meeting.

ELECTRICAL CONTRACTORS' NOTES.

Plans for the electric equipment for the Masonic building at Seattle, for which bids for a general contract will be opened July 15th, have been completed by H. C. Moss, engineer, White building, and plans can be secured from Saunders & Lawton, architects, White Building. The structure will cost $125,000.

The contract for the electric wiring and equipment for the new National theatre under construction at Portland, has been awarded to the Crescent Electric Works.

Star Electric Company has obtained the contract for 35 new fire-alarm boxes for the city of Portland, Oregon. The boxes are of the positive non-interfering type. The price obtained was $80 each.

INDUSTRIAL

A MODERN ELECTRICAL REPAIR SHOP.

The Building.

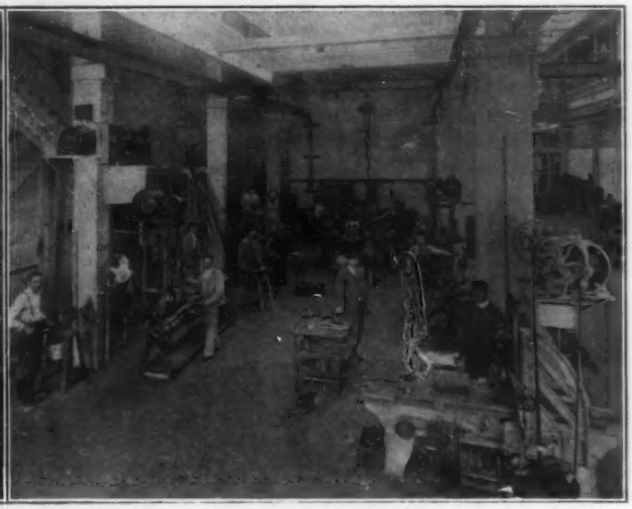
The new shop of the Farnsworth Electrical Works, at 549-551 Mission street, San Francisco, recently built for them, presents many new features. The building has a frontage of 35 ft. on Misison street and 63 ft. on Minna street. It is specially designed for the requirements of expeditiously handling heavy machinery, such as motors, generators, transformers, hoists, etc. It is two stories high and has a 9 ft. basement. The first story is 20 ft. 6 in. in the clear, and the second story 10 ft. The height of the first story was designed to give head room for traveling cranes, two of which are used, of about 7 tons capacity each.

A 2 ton electric elevator with special platform 8x10 ft., runs from basement to second floor.

The second floor is more properly a mezzanine in the shop portion, being 20 ft. wide and running across the rear end and along the west side of building, thus leaving an open bay to the roof.

The roof construction is of the saw tooth type, with glass 6 ft. high facing north. These saw teeth extend across the building, and give a perfect daylight illumination without direct glare from the sun. The roof contains about 4000 sq. ft. of glass, the area of the lot being 7900 sq. ft. Both fronts are glass to a large extent also, so that there are no dark spots in the entire first or second floors, and no artificial light whatever is needed during daylight hours.

Machine Shop and Erecting Floor—Showing Winding Department on Mezzanine.



Individual Drive Machine Shop With Traveling Crane in Background.

Overhead Cranes.

The main crane of 23 ft. span, is designed to run from over the Minna street sidewalk to the Mission street front, thus serving the major portion of the ground floor, with one crane. This enables the loading and unloading of machinery, at the Minna street freight entrance and the placing of finished machinery on the store floor, or show windows without transfer from one bay to another.

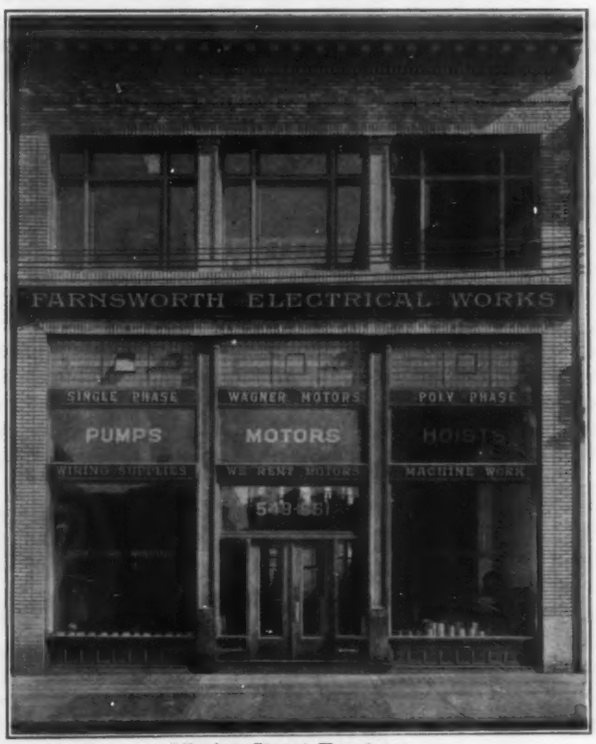
A second crane of 17 ft. span serves the machine shop bay and test department. Both of these cranes are 17 ft. above the floor, thus giving ample headroom for all purposes.

A space 35x50 ft. on the Mission street front is partitioned off for store and office purposes, the partition being so made as to allow the crane to pass through by opening a transom. This method is also used to pass the crane out of rear door over sidewalk. The sidewalk is heavily reinforced and a gutter incline built to enable the heaviest trucks to back up under crane for unloading, etc.

The first floor is used for assembling, cleaning of machinery under repairs; machine shop, tool room and test department. In the test department is a special switchboard.

The second floor is utilized for armature winding, taping, coil making, and as a store room for supplies.

The basement is used for general storage purposes, and also contains a woodworking plant, pipe threading machine, switchboard drill press, transformer vault, and shelving for patterns and forms. A pipe chute is provided on Minna street leading into basement.



Mission-Street Frontage.

Motors Used.

The machine shop equipment is all direct motor driven, individual motors being used throughout. Motor equipment used is as follows:

16 in. Lathe—1 h.p., 110 v., d.c., 1200 r.p.m., Arm. and field control.
14 in. Lathe—1 h.p., 110 v., d.c., 1200 r.p.m., Arm. and field control.
18 in. Lathe—2 h.p., 110 v., d.c., 1200 r.p.m., Arm. and field control.
20 in. Drill—1 h.p., 110 v., d.c., 1200 r.p.m., Arm. and field control.
Sensitive Drill—¼ h.p., 220 v., d.c., 1500 r.p.m. No controller
24 in. Planer—3 h.p., 220 v., d.c., 1700 r.p.m. Field control.
12 in. Hack Saw—¼ h.p., 220 v., d.c. No control.
No. 2 Mitts & Merrill Keyseater—2½ h.p., 110 v., d.c., 600 r.p.m. Arm. control and field.
6 in. Metal Saw—¼ h.p., 220 v., d.c. No control.
20 in. Shaper—1 h.p., 110 v., d.c., 1200 r.p.m. Arm. and field control.
5 ft. Swing Saw—1½ h.p., 220 v., 650 r.p.m., d.c. No control.
32 in. Band Saw—2 h.p., 220 v., 1700 r.p.m., a.c., two-phase. No control.
4 in. Pipe Machine (Line), Marble Drill (Shaft), 3 h.p., 220 v., d.c., 650 r.p.m. No control.
12 in. Jointer—2 h.p., 110 v., 1650 r.p.m., d.c. No control.
Air Compressor—2 h.p., 220 v., 1700 r.p.m., d.c. Pressure control.
Emery Wheel—2 h.p., 220 v., 1700 r.p.m., d.c.
Large Coil Winder—2 h.p., 220 v., back geared, 300 r.p.m., d.c. No control.
Small Coil Winder—½ h.p., 220 v., d.c., 1400 r.p.m. Arm. control.
Field Coil Winder—¼ h.p., 220 v., d.c., 1600 r.p.m. Arm. control.
Taping Machine—½ h.p., 220 v., d.c., 1600 r.p.m. No control.

For lighting, Mazda lamps are used. The basement is lighted with 40 watt lamps arranged in groups of 3 with switches. First floor open bays are lighted with six 500 watts lamps with Holophane Dolier steel reflectors, and under balcony 250 watt lamps with the same type reflectors are used. This size is also used in lighting the second floor. The general lighting thus obtained is entirely satisfactory, rendering portable lamps unnecessary. Switching is so arranged that any portion of the first floor or second floor can be lighted without illuminating the entire shop.

PUSH BUTTON OPERATED BRASS SHELL SOCKETS.

The extensive and satisfactory use of C-H push-button pendant switches and porcelain sockets has been the means of creating a demand for a brass shell socket having indicating push buttons instead of the rotary key and employing the high capacity switch mechanism as used in the above-mentioned switches and porcelain sockets. The rotary key flush switch has given way to the push button type and the push button socket is therefore likely to come into favor also.

The new sockets shown in the accompanying illustrations have a number of important features—indicating push-button operation; quick make-and-break switch mechanism rated at 660 watts, and 250 volts; automatic locking nozzle which eliminates the weak setscrew; cord strain relief in all pendant sockets; and the strong simple snap lock for securing the

Exploded View of No. 7500 Push-Button Brass Shell Socket.

cap to the shell. The mechanism used in these sockets is exactly the same as that used on other C-H devices rated at 750 watts and is only limited to 660 watts because there is no higher rating allowed on screw shell sockets by the underwriters. Because of the extensive use of electrical devices operated from lamp sockets this high capacity socket is particulaly advantageous.

In spite of the many improvements in electrical devices, during the past 30 years, the sockets have always been secured to the fixture by means of an iron set screw and operated by a rotary key, the key being similar to that used on the gas fixture. The new C-H line of sockets has an automatic locking ring to replace the set screw and has indicating push buttons instead of the rotary key.

"Push-the-Button" is an electrical phrase—to operate the new C-H sockets—you "Push-the-Button." The operation is very easy and natural. With pendant sockets this is especially desirable, as only one hand need be used and the lamp is not twisted or jarred. Where a husk is provided on the fixture extension buttons can be placed on the socket, which extend through small holes in the husk and allow operation.

Set Screw Replaced by Locking Ring.

The new locking ring of the C-H sockets makes it possible to attach the sockets securely on varying sizes of fixture nozzles even when a socket cover or husk is used. This is impossible where the setscrew is employed, as a screw-driver cannot be operated inside of the husk to tighten the screw.

Short Electrolier Socket.

Regular Push-Button Socket

A Convenient Push-Button Operation.

In a recent test a C-H socket was secured to one end of a pipe and another socket with the ordinary setscrew secured to the other end. Grasping one in each hand and turning counter clock-wise, the latter socket slipped, damaging the thread, then the joint where the threaded ferrule is fastened to the cap gave way and allowed the socket to slip around. The C-H socket did not loosen in this test.

Another difficulty overcome by this locking feature is the positioning of the buttons. All work during the past few years has been along the lines of providing a multiplicity of catches for snapping the cap on the shell so that the key might be located where desired. This, however, has a tendency to weaken the locking. The locking ring of C-H sockets allows the cap to be turned after it is secured, so that the location of the buttons can be taken care of, while a strong and simple snap can be used which locks the cap and shell securely together. The shell is not weakened by many slots or perforations.

All Pendant Sockets Have Cord Grip.

A cord grip in the pendant type sockets makes unnecessary the usual knots and removes all strain from the terminals. This cord grip does not require any threading through or twisting of the conductors. It is simply necessary to secure the conductor terminals to the binding screws which are placed far down on the socket and are upset. The strength of this cord grip was indicated by a test which resulted in the breaking of a No. 18 two-conductor flexible cord without any strain being transmitted to the socket terminals.

This new socket line put on the market by The Cutler-Hammer Manufacturing Company of Milwaukee consists of push-button and keyless types for fixture and pendant installation besides a short keyless socket especially suitable for small fixtures. The approval of the underwriters has been secured for the entire line.

NEWS NOTES

INCORPORATIONS.

VENICE, CAL.—Neptune Light & Power Company, $5000, subscribed $5, by J. O. Kaiser, L. Bukowski, F. Seeman et al.

SAN FRANCISCO, CAL.—Contra Costa Gas Company, $250,000, shares $100 each, subscribed $500, by S. W. Coleman, J. E. Rodgers, A. F. Bray, W. N. Jones and C. E. Daley.

AUBURN, WASH.—Following the granting of the franchise to J. L. Veach for gas mains, the company which he represents have filed articles of incorporation, with $50,000 capital stock under the name of the Auburn Gas Company.

ILLUMINATION.

DRAIN, ORE.—Voters have signified their approval of the construction of a municipal lighting plant.

WALLOWA, WASH.—The Enterprise Electric Company has been awarded a three year contract for a modern street lighting system.

BUCKLEY, WASH.—The Puget Sound Traction Light & Power Company has taken over the business of the Buckley Electric Company.

COLVILLE, WASH.—The Stevens County Light & Power Company, Colville, Washington, has been negotiating with the city for a municipal lighting system.

EVERETT, WASH.—The Puget Sound Traction, Light & Power Company plans an improved municipal lighting service at a material saving over the old contract.

BOISE, IDAHO.—City officials are considering the installation of a municipal lighting plant because of controversy with the Idaho-Oregon Light & Power Company.

LOS ANGELES, CAL.—A movement is on foot to extend the system of ornamental lights along Long Beach boulevard the entire distance from Los Angeles to the ocean.

LOS ANGELES, CAL.—The board of supervisors of Los Angeles county will receive bids till July 27th, for installing and maintaining an addition to the street lighting system in Laurel Canyon Lighting District.

FORT BENTON, MONT.—An election has been called for July 10th, when citizens of this city will vote on an issue of $17,000 in bonds for the purpose of purchasing an electric light plant or the building of a new one.

BERKELEY, CAL.—The Pacific Gas & Electric Company has commenced the installation of a new distributing system for the district south of Bancroft Way and east of Shattuck avenue, which will cost about $90,000.

DAWSON, YUKON TERRITORY.—The city authorities are planning for the public ownership of telephone, water, light and power. The city is preparing to issue bonds to the extent of $200,000 for the purpose of installing the necessary plants.

ORANGE, CAL.—The movement for ornamental lighting posts throughout the business section of the city is again under way and takes the form of a petition from property holders asking the city board to have electric wires placed underground, the property owners to erect the ornamental poles.

ALBUQUERQUE, N. M.—The Albuquerque Gas, Light & Power Company is engaged in installing a new system of feeders which will do away with poles and wires on Central avenue. This is a part of the general improvement plans of the company, including changes in the lighting system of the city recently authorized by the city council.

REDONDO BEACH, CAL.—The board of trustees has adopted the design submitted by the Llewellyn Iron Works for ornamental lighting posts to be installed here. A 5 light system will be installed on Catalina and Pacific avenues, a 1 light system on Camino Real, a portion of Catalina avenue, and on the Esplanade, and a 3 light system on Diamond street.

NEWPORT, CAL.—O'Melveney, Stephens & Milliken of Los Angeles, have declared the $25,000 municipal bonds of Newport, for a street lighting system, invalid. The bonds were recently sold to W. K. Parkinson and Lew Wallace, president and treasurer of the board of trustees, respectively, subject to the approval of the bond firm. The contract has also been let to the F. O. Engstrum Company for the installation of a 138 post street lighting system. Proceedings will be started at once for a $20,000 bond election.

LOS ANGELES, CAL.—As the first step toward the acquisition of a municipal lighting system, for which $6,500,000 was voted last month, the city council, meeting with the board of public service commissioners, has decided that the Southern California Edison Company's distribution system was preferable for the city's purpose, that proceedings be immediately instituted to secure the possession, and an attempt be made to secure the electric distribution system by an amicable adjustment without recourse to litigation. A communication will be addressed to the Southern California Edison Company officials, formally asking if they will agree to sell to the city at a price fixed by the State Railroad Commission. If the company refuses to accept this proposition, condemnation proceedings will be immediately instituted.

SALT LAKE CITY, UTAH.—The Dooly Building Power Company has made application to the city commission for a franchise to furnish electricity and steam heating in Salt Lake City. The application is accompanied by a letter stating that the company intends to extend its service only throughout the immediate vicinity of its present plant. The Dooly Building Power Company was organized by the late John E. Dooly several years ago to furnish electricity and steam heating service to the Dooly building and to several other buildings in the immediate vicinity of it, in which Mr. Dooly was interested. The Dooly Estate has recently erected several large buildings in the vicinity of the original Dooly building which necessitate the enlargement of their heating and generating plant. This application is made to enable them to supply service to other customers in the vicinity in case they desire to do so.

SAN FRANCISCO, CAL.—In the electric light rate ordinance passed by the supervisors the system of charging is materially changed, but there is only a slight change in the actual cost to consumers. According to Vice-President Britton of the Pacific Gas & Electric Company, consumers will save about $70,000 a year. Britton said he did not think the ordinance entirely fair to the company, but that no effort would be made to fight it. The new schedule calls for a graduated scale running from 7c per kw.-hr., which is charged for the first 50 kw. hours in each month, down to 3½c per kw.-hr. The present base rate of 6c is being contested in the courts. The gas rate for the ensuing year was fixed at 75c when the supervisors, after being deadlocked through four ballots, finally accepted the recommendation of the lighting and rates committee and refused to make the rate 80c, as demanded by the Pacific Gas & Electric Company. At the outset of the meeting Mr. Britton delivered his ultimatum of an 80c rate or a legal fight in the Federal courts.

SALT LAKE CITY, UTAH.—The property owners of State street met at the National City Bank on Tuesday, June 23d and organized the State Street Improvement Association with Hyrum Pingree, cashier of the National City Bank as president, Herbert S. Auerbach, of Auerbach & Company, vice-president, and Percy O. Perkins, representing the G. S. Holmes interests, as secretary. The object of this

association is to advance the business interests of State street property owners and tenants. State street has rapidly come to the front in competition with Main street as a business thoroughfare and much of this has been accomplished through the enterprise of the merchants and property owners there in installing an ornamental street lighting system and by the liberal use of light in their businesses. One of the principal purposes of forming this organization was to promote an even more elaborate system of ornamental lighting than the present one and to secure better street car service for State street. A committee was appointed to investigate the various systems of street lighting now available and to report to the association at their next meeting.

TRANSPORTATION.

POMONA, CAL.—The city council has passed an ordinance granting to the Pacific Electric Company franchise necessary for the construction of a road from Lordsburg to North Pomona to connect with the line to San Bernardino.

SEATTLE, WASH.—Seattle inaugurated its first municipal street car service on May 23, 1914. On May 30, 1914, the Lake Burien line of the city began conducting a commercial business. The first line and locally designated as division A, extends into Ballard. The second line operates in the southern part of the city.

GLOBE, ARIZ.—The State Corporation Commission has granted a permit to the Globe & Miami Traction Company to sell $75,000 in stock and a similar amount in bonds, for the construction of an electric interurban railway service between Globe and Miami. Geo. Hill, attorney for the traction company, and Mr. De Tar will undertake the sale of stock at once.

SAN DIEGO, CAL.—The Bay Shore Railroad Company has been granted a franchise to build an electric railway from Ocean Beach across the channel of False Bay and along the Strand to Bird Rock Beach. The application for the franchise was presented by Chas. Fox as president of the road, and J. H. McKie, secretary. Work is to start within three months.

OAKLAND, CAL.—A passenger traffic agreement between the Oakland, Antioch & Eastern Railway and the Pacific Coast Steamship Company has become effective. By this agreement passengers from any point reached by the railway may purchase tickets through to any point reached by the steamship company. A similar agreement with the Pacific Navigation Company has been in effect for several months.

SACRAMENTO, CAL.—The latest official of the Northern Electric to hand in his resignation is J. B. Rowray, for many years assistant general manager and acting manager since the retirement of A. D. Schindler June 1st. W. A. McGovern, new general manager, and J. R. Wilson, general freight and passenger agent, after a trip of inspection last week, professed themselves highly pleased with the physical condition of the road.

SAN FRANCISCO, CAL.—The construction of the new car barn for the Municipal Railway on the block bounded by Seventeenth, Mariposa, York and Hampshire streets, is to be begun soon. The board of works has called for bids for excavating the site. The board received three bids for the underground electrical conductors for the railway lines, the lowest bidder being the Pacific Fire Extinguisher Co., whose offer amounted to about $24,000.

SAN FRANCISCO, CAL.—A possible solution of the problem of building the proposed extension of the Muncipal Street Railway system over Church street was suggested to the public utilities committee when it was proposed to abandon all idea of cutting a street for that district on a contour plan and simply to purchase a right of way for the street car tracks. This will only have to be about 20 feet in width. This expense was never contemplated in the bond issue, but the residents have refused to have an assessment district formed for the supplying the street and city is now proposing to get the tracks over the hill the best way it can with the least possible expense.

SAN FRANCISCO, CAL.—Plans for the acquirement of the United Railroads by the city has been announced by Alexander Vogelsang, chairman of the public utilities of the supervisors, as follows: "There will be no bond issue. The city intends to pay for the property out of its earnings. First of all, there will be an appraisal of the physical property. This will be followed by an appraisal of the franchises. The principal franchises expire in 1929, although there are others that expire at intervals until 1952. It will be proposed to pay the company an amount equal to the sum of these two appraisals, giving a guarantee of interest at a reasonable rate. The property is then to be operated by the city, the extensions made by the city, maintenance to be cared for by the city. All of the net profits are to be devoted to extinguishing the debt due the United Railroads. A charter amendment will be necessary to put this plan into execution."

TELEPHONE AND TELEGRAPH.

GRESHAM, ORE.—The Gresham Telephone Company will build a circuit to Sandy and to Cottrell.

ELLENSBURG, WASH.—The Ellensburg Telephone Company will build a rural line to Edgemont district.

NELSON, B. C.—Appropriations have been made for a federal telephone line to be constructed across and along the east side of Kootenay landing.

BUTTE, MONT.—W. J. Tonkin has asked the county commissioners for permission to construct a telephone line betwen Basin Creek schoolhouse and the Five-Mile House.

CENTRALIA, WASH.—The Evergreen Telephone Company, Klickitat Telephone Company and Claquato Telephone Company have each applied to the county commissioners for a franchise to operate over the county roads.

PORTLAND, ORE.—The Home Telephone & Telegraph Company has let a contract for the erection of a new exchange for Sunnyside district at East Forty-fifth and Madison streets, to Hurley Mason Company for $10,000.

LOPEZ, WASH.—Joseph Thornton of Lopez Island and others are forming a stock company to lay a cable of six wires from Lopez Island to Green's Point on Fidalgo Island to connect wires of Independent Telephone Company.

LOS ANGELES, CAL.—Bids will be received up to July 27th, by the board of supervisors of Los Angeles county, for the purchase of the franchise applied for, granting the right to maintain for a period of 30 years, telephone and telegraph systems in certain portions of the county.

YUCAIPA, CAL.—Work upon connecting of South Beach with a telephone system will commence at once. Lines from the townsite to three large pumping stations will be built by the Southwestern Home Telephone Company of Redlands, which controls the telephone service of the valley.

PORTLAND, ORE.—The Bell Telephone interests have asked the U. S. Government for permission to consolidate the Pacific Telephone Company and the Home Telephone Company exchanges at Spokane, and also to dispose of its $721,000 holdings in the Northwestern Long Distance Telephone Company.

TRANSMISSION.

DEMING, N. M.—The Inspiration Copper Company has decided to issue $4,500,000 in bonds to erect a large power plant to cost about $1,500,000. The management will use power to run a big concentrating plant to be erected at the mines at Miami.

LOS ANGELES, CAL.—City Attorney Stephens has advised the city officials that the public service commission has full authority to handle the expenditure of $6,500,000 power bonds money for construction work and acquirement or construction of a distributing system.